Design News

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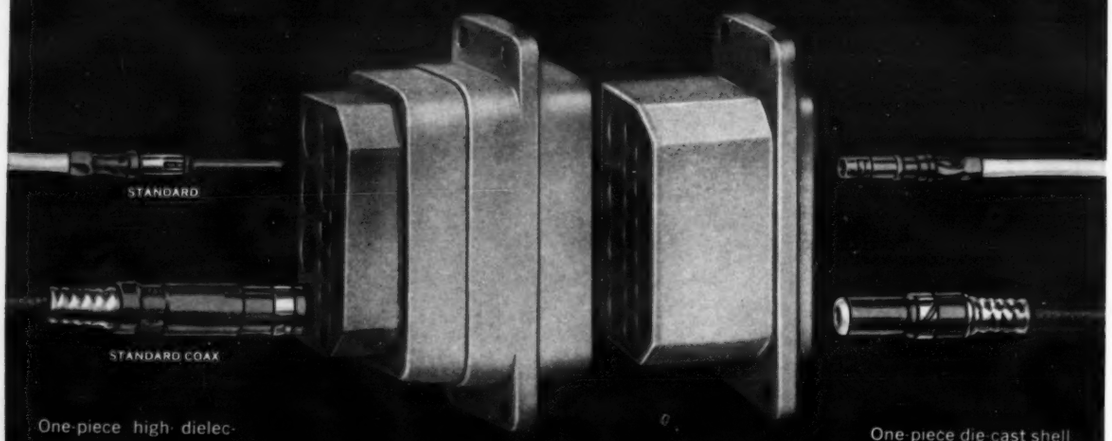
A ROGERS PUBLICATION

JANUARY 30, 1961

HYFEN

RACK and PANEL CONNECTORS

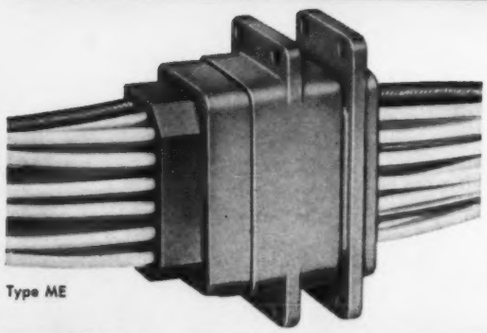


One-piece high-dielectric strength insert contains molded-in ferrules for positive contact retention. Eliminates one cause of moisture entrapment.

Configurations accommodate three types of contacts: 1. Standard 2. Standard Coax 3. Miniature Coax (below), in any combination. All are plated in accordance with your requirements and are crimp-type, snap-locked HYFEN contacts.

One-piece die-cast shell design permits inserts to be interchanged in shells . . . allowing dead front in either plug or receptacle.

crimped-contact reliability—snap-lock versatility



Type ME

Burndy's line of rack and panel HYFEN connectors offers the high reliability of crimp-type, snap-locked contacts. The versatility of the HYFEN technique is increased by the accommodating of a wide range of wire types and sizes . . . coax, miniature coax and standard cable.

FOR FURTHER INFORMATION CONTACT OMATON DIVISION

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January 30, 1961
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Circulated without charge upon request on Company letterhead to design engineers in plants manufacturing engineered equipment in the continental U.S. who are responsible for the specification of parts, materials, finishes and engineering department equipment. Subscriptions to others in the continent United States, $20 per year.

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Via G. Carducci (Borgoest).....Melegnano 346

Zurich 6, Switzerland .....
Stampfenbachstrasse 61..... Tel. 26 24 14

Published bi-weekly by Rogers Publishing Co. Editorial, Advertising and Subscription Offices: 3375 S. Bannock, Englewood, Colo. Telephone: SUnset 9-0571.

Published at 85 W. Harrison St., Chicago 5, Ill. Accepted as Controlled Circulation Publication at Chicago, Illinois. Send form 3579 to subscription offices.

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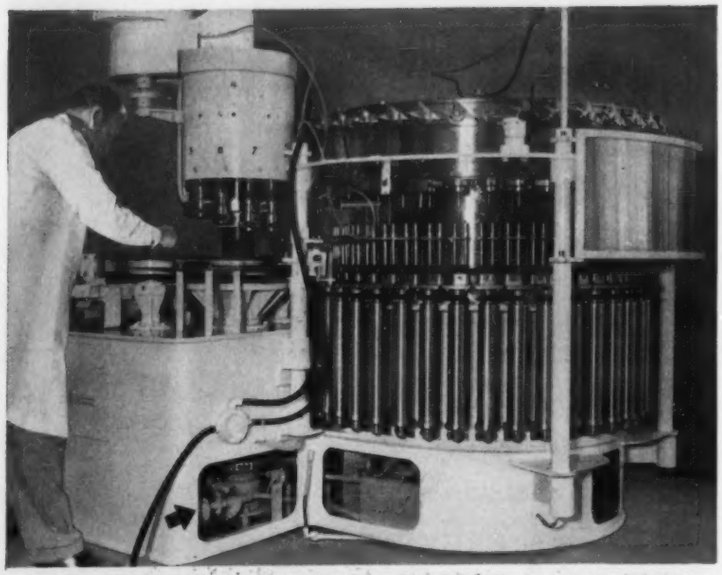

CEM "Uni-Blend" Filler manufactured by Crown Cork & Seal Co. for beverage industry.

Crown Cork & Seal Co. put B&S Pumps in 50 new machines - never had a failure or a complaint!

The whole top of this new bottle-filling machine revolves on a thin film of oil that is maintained in a large hydrostatic bearing by a pump. The same oil acts as a seal for air, being distributed to bottle-lifting cylinders right through the bearing.

B&S No. 111 ¼ hp motor-driven gear pump (arrow) supplies oil at 35 psi to hydrostatic bearing.

It's easy to see that this manufacturer can't take chances on a pump failure; if the pressure drops, the whole machine shuts down. At customer production rates of up to 320 bottles a minute, it would be a very costly failure.

That's why Crown Cork & Seal Company uses Brown & Sharpe pumps. They are built to the high quality standards of machine tools.

Of the Brown & Sharpe pumps Crown has put in 50 new machines — not one has ever failed or caused a complaint.

For trouble-free pumps in *your* machines—contact Hydraulics Division, Brown & Sharpe Mfg. Co., Providence 1, R. I., or your nearest B&S engineer-representative.

Brown & Sharpe

PRECISION CENTER

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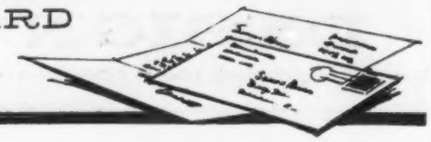
SOUNDING BOARD

FOR OUR READERS



Eight Times the Fatality Rate from Polio

Your editorial, "Auto Safety—a Record?", in the Nov. 7 issue of DESIGN NEWS is to be heartily applauded. Especially significant is your implicit recognition of the automobile design safety problem as a problem of national policy as well as a technical problem.

The question of whether cars will be safer has two aspects: (1) the question of whether all possible technical methods will be researched, and (2) the question of whether the newest proven technical methods will be encouraged in the market place so that they can be placed in use. An example of technical possibilities that are not being researched is that of systematic design of cars and trucks for pedestrian injury reduction when an accident happens. I have never seen nor heard of a single systematic research effort along this line, although I have been in close contact with the field of automobile safety for about four years. Yet the number of deaths among pedestrians annually is about 7800, nearly eight times the fatality rate from polio, a disease on which millions were spent every year. (I have seen one isolated test in which a collision with a bicycle was simulated. It was done by a private organization outside the industry.)

In the question of encouraging or discouraging "optional" safety devices, the policy battle is accelerating, not slowing down. Some elements of the automobile world formally praise safety devices while their friends indulge in a bit of "hidden persuasion", helping to hint that everything is all right or that it's all someone else's problem. One oil company recently ran a series of nation-wide "driver-educating" advertisements, all of which ended with the slogan in enlarged type, *"Your Car Has Built-In Safety—You!"* (Emphasis theirs.) A national automobile finance company offered a radio plug for careful driving with the heavily emphasized conclusion, "The best safety device your car can have is you!"

One can't help wondering which of the "senior automotive executives responsible for policy decisions" chooses to accept your invitation to reply to your editorial. The question of "who is responsible" is very important in the issue. In the recent past each group who can influence the decision has been pointing to the other and saying, "Yes, it does seem that I am partly responsible, but the real responsibility is with that other fellow." Then it's easy to argue that there's no policy decision involved. Everyone is merely "giving the public what it wants".

In terms of lives being lost every day, the gap in automobile safety is even more important than the nuclear weapon question. The continual and unnecessary loss of life is probably the most important issue in the technical world today.

HENRY H. WAKELAND
New York, N. Y.

Auto Safety

Congratulations on the editorial and subject excellence of DESIGN NEWS.

May I have permission to make reference to and quote from your editorial on automotive safety of Nov. 7, 1960? Would you be so kind as to extend this privilege to the articles written by your Mr. Victor W. Wigotsky in the Nov. 7, 1960, and Aug. 29, 1960, issues on the same subject?

I would also appreciate your permission to refer these articles to the local chapter of The Travelers Protective Association, an organization dedicated to safety in all fields.

Thank you.

ALEXANDER SCHWAN, JR.
Design Engineer
General Electric Co.

• **Permission granted.**

A Match for Genghis Khan

A friend has sent me copies of the editorials by you and Mr. Wigotsky in the Nov. 7 issue. It is a pleasure to see the ideas propounded so cogently.

I am particularly interested that the offer in your last paragraph be accepted by Mr. ——— — ———, who, in my opinion, is personally responsible for almost as many deaths as is Genghis Khan. An example of his approach and insight is afforded by the enclosed pamphlet which I have distributed widely as an example of the almost complete lack of insight on the part of some high automotive officials.

I hope you will send him a marked copy of the Nov. 7 issue. If you do not care to do this, I would be pleased to do it. Which method do you think would be more likely to get a response? . . .

HORACE E. CAMPBELL, M.D., F.A.C.S.
Denver, Colo.

• **Neither. E. R. C.**

Federal Aid

Much is being said by newspapers, radio and TV that something will have to be done to improve our entire educational system. It will also continue to be a subject much debated in political circles. In short, the subject has become a political football.

At the risk of being called a complete reactionary, I want to submit three ways in which the federal government can help at the upper levels of the educational system. All three are predicated on a sound base for our children through grade and high school—a base which in many states is sadly lacking. I am sure that thousands of educators are working on this problem and that solutions will be found for better preparation of students before they reach college age.

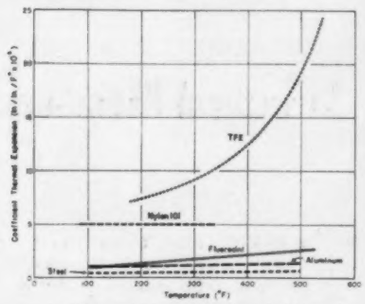
If we are to produce qualified people in scientific and engineering fields, in the numbers apparently required by the cold war, I see three things which the federal government can do immediately: (1) Allow income tax deductions for money spent on education. (The high cost of a college education should not be the burden that it is.) (2) Cut down on undeserving and nonqualified students in our institutions by requiring tests to show the ability to learn and the desire for a higher education. (IQ tests are certainly not infallible but in the present state of the art it is possible to test our high school students quite thoroughly during their 3 to 4 years of preparation. Crowded conditions at our colleges and universities could be alleviated by requiring suitable scores in batteries of tests for admission.) (3) Make money available in the form of loans for deserving students who pass suitable tests. (Such loans could be paid back in the form of higher income taxes after graduation, until the loans are fully repaid.)

No one can say with any degree of certainty how many of our present college and university students really have no business in an institution of higher learning. Undoubtedly many are there simply because of an ability to pay the cost rather than any ability to learn. Meanwhile there are still many potentially good students who are not able to go to college simply because of a lack of money. How many incipient scientists, mathematicians, engineers—professional people of all kinds—have we lost due to the money factor alone? The government could certainly help at very little additional cost to the taxpayers. I will welcome comments from readers.

J. P. Dubois

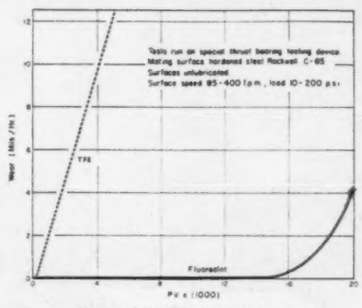
Managing Editor

See how FLUOROSINT® parts can outperform regular TFE Fluorocarbons



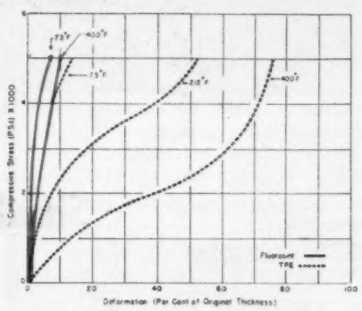
LINEAR COEFFICIENT OF THERMAL EXPANSION VS TEMPERATURE

(1) in dimensional stability FLUOROSINT's coefficient of thermal expansion is as low as aluminum.


Tests run on special thrust bearing testing device
Mating surface hardened steel Rockwell C-65
Surfaces unlubricated
Surface speed 85-400 f.p.m., load 10-200 p.s.i.
TFE
Fluorosint
Wear (Mils / Hr.)
PV x (1000)

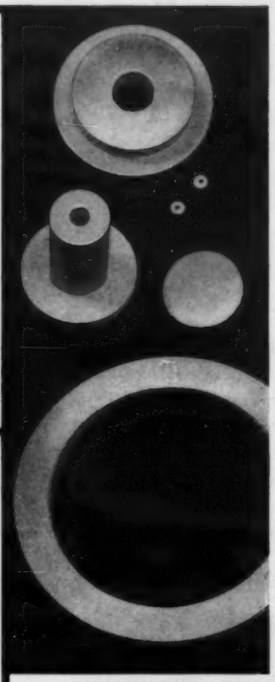
BEARING CHARACTERISTICS (WEAR MILS / HR VS PV)

(2) in bearing characteristics FLUOROSINT operates at higher loads and speeds, shows far more wear life.



COMPRESSIVE STRESS VERSUS DEFORMATION AT VARIOUS TEMPERATURES

(3) in resistance to cold flow and creep FLUOROSINT parts are more rigid, resist deformation at high temperatures.



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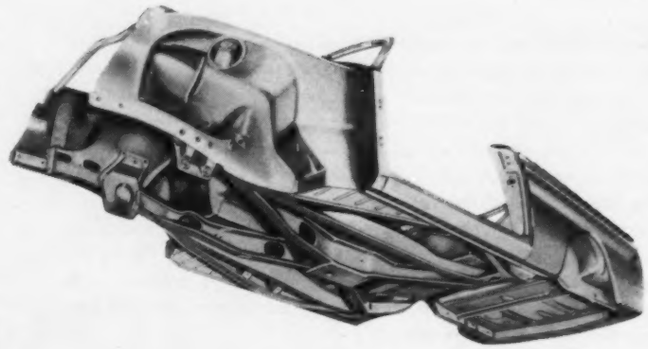
Structural Members Reinforce Convertible Unit Body

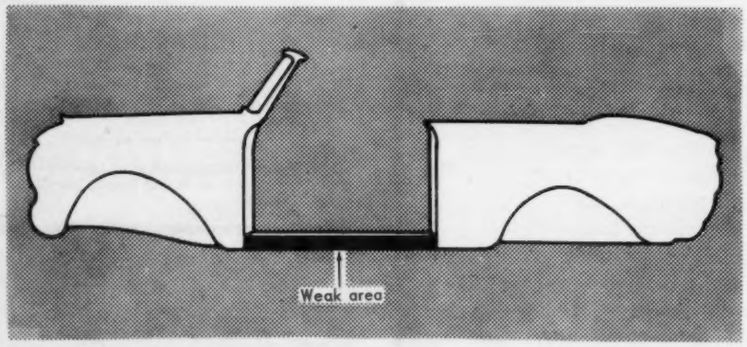
Robert L. Candlish, Detroit Editor

DETROIT, MICH.—Six longitudinal and diagonal members extend from front to rear suspension support areas to provide beam and torsion structural rigidity in the first American-built unit body convertible car. The degree of stiffness provided is equivalent to that in a conventional sedan body having two basic longitudinal members. Use of heavy-gauge metal plus rustproofing prevent loss of structural strength by corrosion.

The unit body convertible is the Rambler American Custom model by American Motors Corp.



REINFORCING STRUCTURE is made up of six longitudinal and diagonal members welded into single unit with floor pan. Outside members deflect outward to incorporate rocker box structure into structure. Inside members deflect inward and are tied by center plate to form X member for maximum torsional rigidity. Two structural members are straight longitudinal for maximum beam strength. Press-formed floor pan also is structural member.



STRUCTURAL STRENGTH of convertible body must be built into floor pan. Roof structure that contributes considerable strength in conventional bridge construction unit body is not available. Body section from front door post forward is box-type structure with welded-in dash. Section aft of rear door post is also box-type structure with welded-in rear seat back support.

Shoulder Joint Improves Strength of Small Sucker Rod

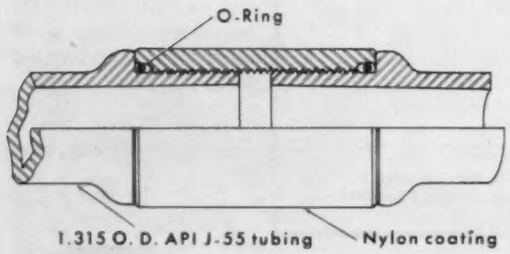
Edward W. Schrader, Western Editor

TULSA, OKLA.—Macaroni tubing with shouldered joints eliminates high stresses imposed on the last engaged thread of the tubing at the coupling. With conventional joints, lacking a shoulder, the material under the last engaged thread is subject to bending.

Pressure at the shoulder face is greater than any load imposed on the string. Proper torque eliminates bending of the pin.

The sucker rod is hollow and can be used to pump up through the inside or on the outside annulus of the rod. Pumping through the annulus between the drill pipe and the rod reduces rod stretch. This is due to the large amount of buoyancy when the center is free of oil.

The macaroni sucker rod is designed and produced by the W. C. Norris Div., Dover Corp., and is distributed by Vinson Supply Co.



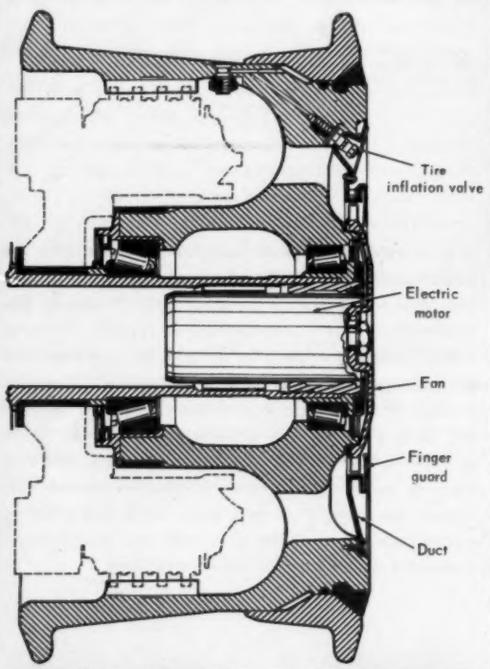
SMALL-DIAMETER SUCKER ROD used for slim hole completion. Shoulder on upset end butts against collar. Straight, unified-series threads permit closure at collar and shoulder. Rubber O-ring in annular space protects against sanding conditions. When pumping up through rod, nylon coating can be supplied on outside diameter of collar.

Fan-Cooled Hubs Achieve Safer Aircraft Braking

Ronald W. E. Martin, British Editor

LONDON, ENGLAND—A small fan, driven by a fractional-horsepower electric motor, is incorporated in the wheel hubs of Comet IV aircraft to provide forced ventilation in the braking system.

Developed by Dunlop Rubber Co., Ltd., the air-cooled brake is claimed to have cut aircraft turn-around time by 80 to 90 percent.



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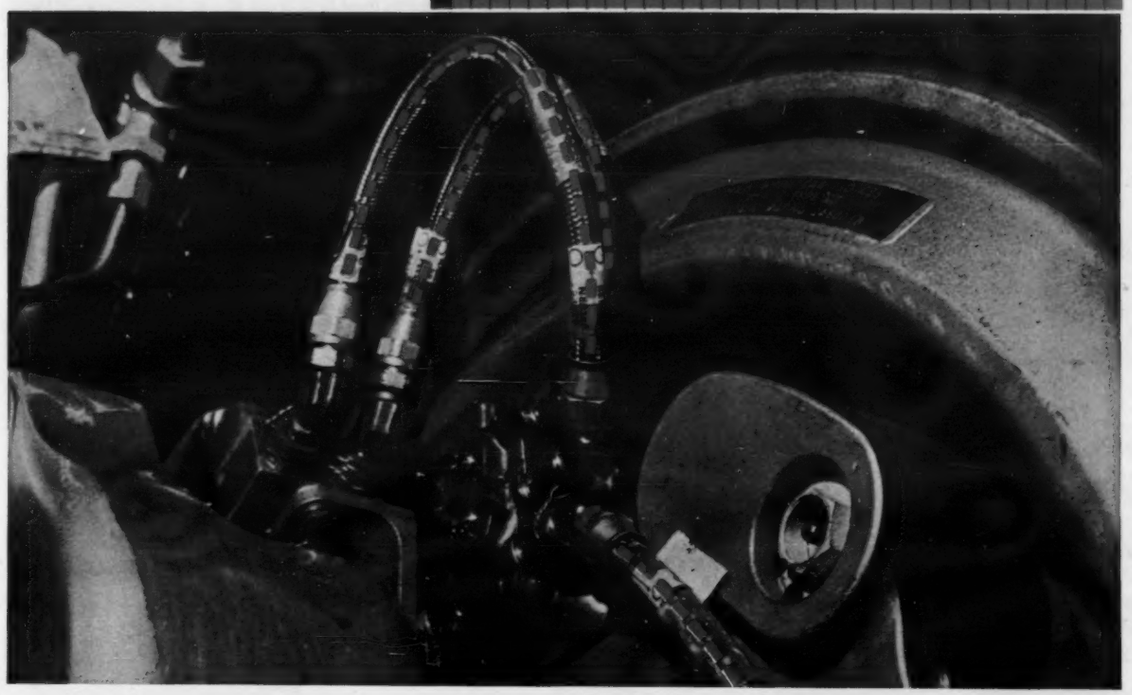

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. . . functional reliability and greatly increased service life

. . . reduced costs of replacement, maintenance and downtime

. . . greater standardization with reduced inventories

. . . the competitive advantage of quality and dependability

If any of these considerations are important to your design, the choice of any other kind of hose might well be wasteful.

Hoses lined with Du Pont TEFLON TFE fluorocarbon resins are employed throughout a new commercial cargo plane to insure the utmost reliability under exacting service conditions. Shown above are hose lines to the hydraulic anti-skid brake system, operating at 1,750 psi and in the presence of corrosive fluids. In addition to these fluid power lines, other hoses lined with TEFLON handle oils and fuels at temperatures to 200°F. and pressures up to 3,000 psi.

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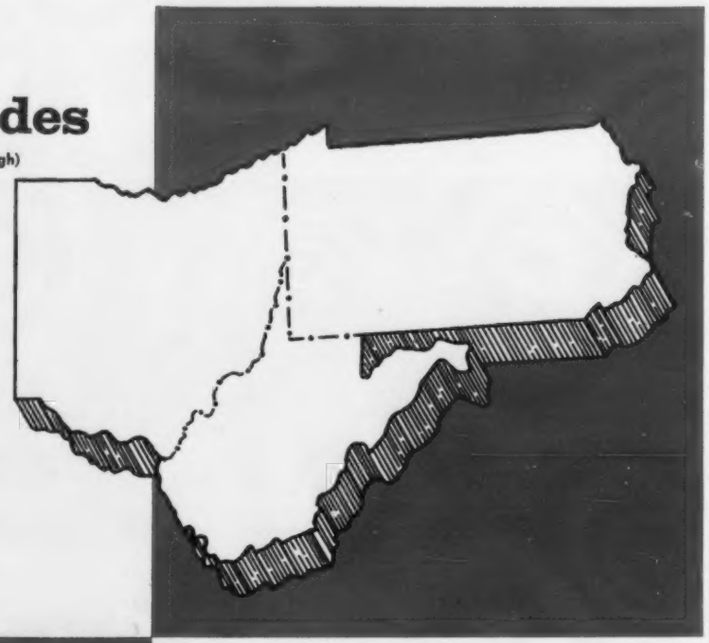

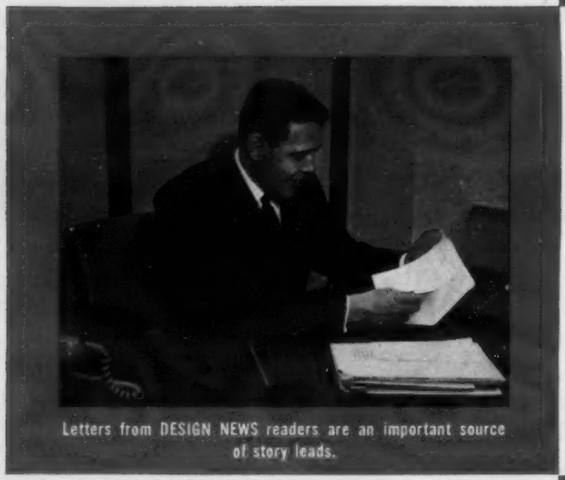

Letters from DESIGN NEWS readers are an important source of story leads.

for Design News

Ed or "E. J." as he prefers to be called, has a tight territory ...only three states. But his editorial beat is a vital part of the heartland of industrial America.

E. J. is always on the move in search of new Design Ideas.

It's his job to find them, to select pertinent facts, drawings and background material...and then to report them accurately and concisely to you, the Design News Reader.

Of course, many of his leads come by phone or letter from men like yourself. These he follows up in person.

Do you have an interesting Design Idea now past the preliminary design stage? If so, contact **E. J. Stefanides, Central States Editor, Design News, 1 Gateway Center, Pittsburgh 22, Pennsylvania, ATlantic 1-8822.** He'll be glad to discuss a possible article with you.

Engineer-Editor Stefanides is briefed on new Design Idea before he collects details.

By E. J. Stefanides, Central States Editor

FREE ENGINEERING

How much free engineering do you do? "Far too much," says the top engineer of one food-machinery manufacturing firm. He continues, "Only one out of 10 proposals that we lay out and for which we do the preliminary engineering materializes as a subsequent order, and since these plans can become quite involved, the free engineering costs can become formidable."

A somewhat different complaint is voiced by the sales manager of another firm specializing in heavy-duty machine tools for the steel mills. He complains that many of the manufacturers of systems for automatic control are loath to do any engineering until an order is actually placed. In his words, "They tell us that it can be done and approximately what it will cost, but they are extremely reluctant to fill in any details during the initial inquiry stage. This can become embarrassing when dealing with our customers since many of their boys have had a lot of experience along these lines and can ask detailed questions which we can't always answer."

Although these two viewpoints would appear to be poles apart, they do reflect a common problem. Just how much preliminary engineering work should the customer expect to be done on speculation—particularly in regard to custom equipment? After all, we know who pays the costs of the proposals that don't materialize, and yet the prospective purchaser must have the facts in order to justify his purchase, or sell the ultimate user. Where should the line be drawn?

EVALUATING THE COMPETITION

From time to time, I run across stories concerning the unusual lengths to which a manufacturer will go in order to obtain information concerning the competitors' products. To date, one of the best concerns the XYZ Co., a medium-sized firm, manufacturing a specialized line of equipment.

When its chief competitor came out with a new offering, it was impossible to buy one for evaluation through the usual channels because of the specialized nature of the equipment. What did they do? One of their sales or service men had some connections in their customer's receiving department. Through his efforts one of the first of the new models received was delivered via the customer's truck to the XYZ plant. It was taken to a secluded section of the plant, uncrated, connected to the utilities and given a quick performance test. It was then disassembled for examination by the engineering and production experts and the component parts were laid out and photographed. After photographing, it was reassembled, recrated and redelivered to the customer's plant. I wonder what the competition was doing while this was going on?

ENGINEER JONES

How do you sell engineering? One of the simplest jobs of selling and promoting the profession that I have seen is practiced by an engineer in Pittsburgh. His method—he simply substitutes the word "engineer" for Mr. when speaking of his fellow engineers by name. The results—a trifle disconcerting the first few times around, but soon recognized to be a mark of esteem and respect. In fact, after awhile you begin to hope that he prefaces your name with "engineer" in his conversation with others.

there are always good reasons for designing it in AVISUN polypropylene

This polypropylene trap catches all foreign items and prevents gurgling in RCA Whirlpool's 1960 Automatic Washer. AviSun Polypropylene's excellent molding characteristics make possible the intricate, cost-saving design of the molded-in baffle and air vent. Custom-molded by Precision Plastics, Columbia City, Ind.

in RCA Whirlpool washers *it's heat and chemical resistance*

RCA Whirlpool engineers selected AviSun Polypropylene over all other materials for this hard-working automatic washer part. It withstands highest water temperatures—resists all common detergents and bleaches—shrugs off tough battering by coins and other items left in clothes being washed. And, it's more economical to manufacture and install.

Polypropylene makes better products at lower cost. No other material has this combination of properties:

1. Heat Resistance
2. Chemical Resistance
3. Toughness
4. Economy

AviSun's technical specialists will gladly assist you with specific applications—write, or phone LOcust 8-5520.

AVISUN*

*a trademark of AviSun Corp.

Mail coupon for technical information
AVISUN CORPORATION
Dept. 429, 1345 Chestnut St.
Philadelphia 7, Pa.

Send me Booklet AP-601 covering full technical information on AviSun Polypropylene.

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DESIGN SPECIAL REPORT NEWS

Welded Diaphragm Bellows — Part 1

Victor W. Wigotsky, Eastern Editor

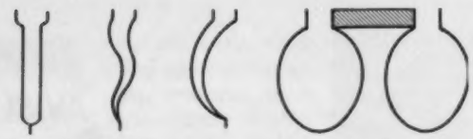
The versatility of welded diaphragm metal bellows has created many new uses and improved performance in many conventional applications. Welded bellows as a torque transmitting device on a submarine periscope and as a replacement for a spring in a fluid-filled control mechanism are only two examples. They illustrate how the performance of these bellows can be varied to suit the need.

The following article describes welded bellows as sensors for pressure changes, as seals for rotating and reciprocating shafts, as seals for valves, and as flexible connectors, accumulators and shock absorbers. A previous article (DESIGN NEWS, May 9, 1960) discussed welded bellows to compensate for volume changes of fluids in sealed instruments.

In all of these applications, one or more of the following characteristics are used to advantage:

1. Constant effective area with change in pressure.
2. Long stroke per unit length.
3. Short nested length.
4. Large volumetric compensation for short free length.
5. Excellent spring characteristics and pressure deflection curves.
6. Ability to withstand high pressure.
7. Ability to withstand high temperature.
8. Long life under operating conditions.
9. Excellent corrosion resistance determined by choice of material.
10. Reduced outgassing of evacuated and sealed assemblies because of welded technique.
11. Leak tightness to mass spectrometer sensitivity.

The state of the art of design and fabrication of welded diaphragm bellows is continually advancing. From the analytical viewpoint, the subject is an extremely complicated one. From a practical viewpoint, however, the design engineer needs to know what constitutes good bellows design and he should be able to establish reasonable envelopes and performance specifications.



CHARACTERISTICS OF DIAPHRAGM CONTOURS

	Flat Plate	Nesting Ripple	Single Sweep	Torus
Resistance to pressure	Fair	Poor	Good	Exc.
Long stroke capability	Poor	Exc.*	Fair	Fair
Linearity of force output with pressure	Exc.	Poor	Fair	Exc.
Linearity of stroke with pressure	Exc. for short stroke	Good	Fair	Good
Spring rate	Low	Low	High	High

** Nesting ripple bellows can be built so that the free length is the nested length and all the stroke is in extension.*

Other performance requirements for bellows not related to contour are: temperature, corrosion resistance and life.

APPLICATIONS FOR BASIC CONTOURS

	Flat Plate	Nesting Ripple	Single Sweep	Torus
Pressure sensitive, null	A		B	A
Pressure sensitive, actuator	B	A	B	B
Rotating shaft seal	A		B	B
Valve and shaft seal		A	A	A
Flexible connector		A	A	B
Accumulator		A		

A — Primary applications, B — Secondary applications

Basic Diaphragm Contours

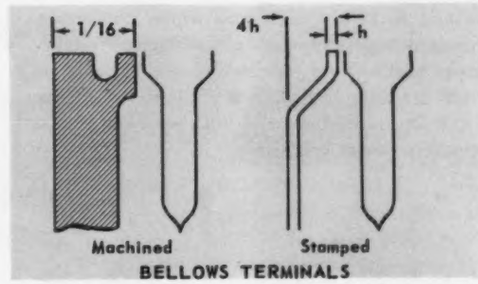
Chart describes four basic diaphragm contours. Each type can be varied to achieve special characteristics.

Definitions of Applications

Pressure sensing, null: to convert pressure into force. Pressure on effective area produces thrust through short distance. Linear force output over wide pressure range is characteristic.

Pressuring sensing, actuator: long and often linear stroke with pressure.

Rotating Shaft Seals: bellows act as flexible seal to maintain uniform force on face seal under operating conditions. Moderate strokes, constant effective area and good spring characteristics are required.



BELLOWS TERMINALS

Valve and Reciprocating Shaft Seals: bellows act as a flexible seal. Long stroke is usually essential factor. However, diaphragm contour may be determined by one or more of the following design factors:

1. Pressures of 1000 to 10,000 psi.
2. Temperatures of 800 to 1500F.
3. Corrosive media.
4. Close control of effective area and spring rate.

Flexible connectors, ducting and expansion joints: long stroke, deflections transverse to bellows axis, pressure and vibration are important considerations.

Accumulators and shock absorbers: bellows act as flexible container capable of large changes in volume with change in pressure. Long stroke for short free length is predominant characteristic.

Bellows Terminals

Terminals (also referred to as headers, fittings) may be made from strip, plate, bar, castings or forgings of a metal compatible with the diaphragm material. In most cases, machined terminals have the advantage of including tapped holes, threaded studs, pilot diameters or O-ring grooves, making it simple to install the bellows into the next assembly. Terminals stamped from light gage strip or sheet will deflect somewhat when the bellows is under load. If this is objectionable, more rigid machined terminals are required.

Joining the bellows to the terminal at the OD is preferable but there are cases where ID joints are

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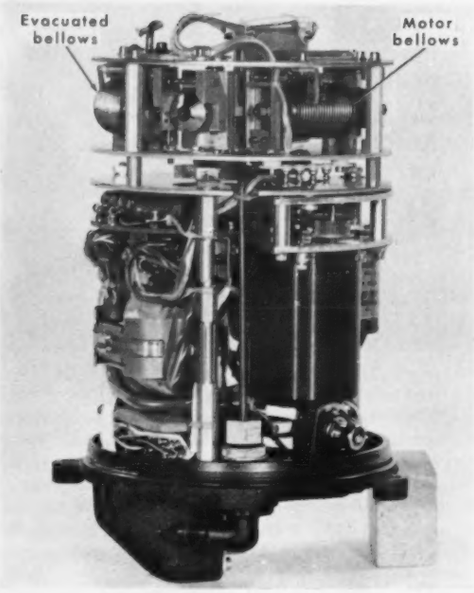
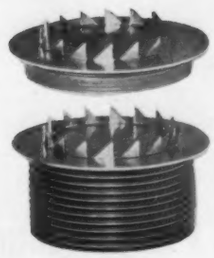
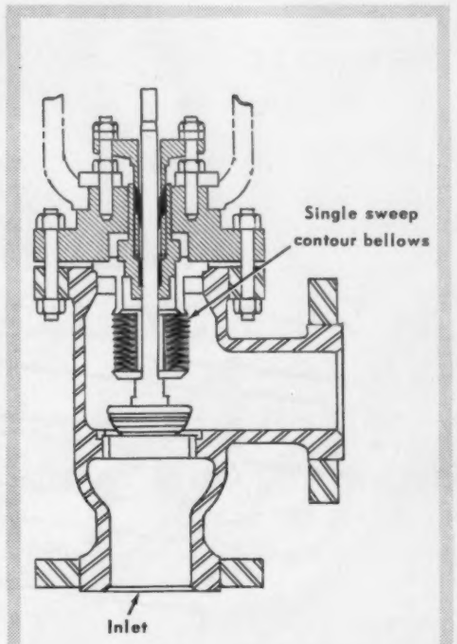




NESTING RIPPLE BELLOWS

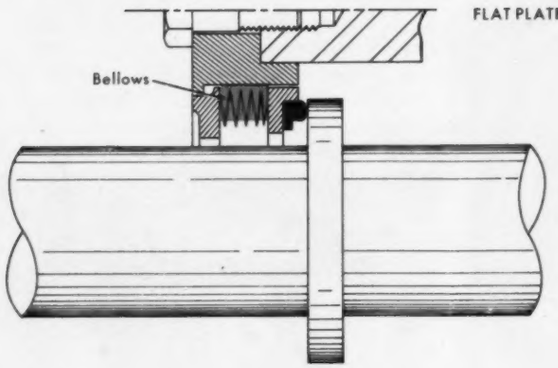
AUTOMATIC PARACHUTE RELEASE: Arming cable of parachute release is automatically pulled at instant of pilot and seat separation. Nesting ripple bellows assembly prevents parachute deployment until pilot falls to pre-selected altitude.

PRESSURE SENSING, NULL APPLICATION: Motor bellows senses operating pressure. Evacuated bellows supplies reference to absolute pressure. Servomotor returns motor bellows to null position. Bellows' diaphragms are flat-plate type.

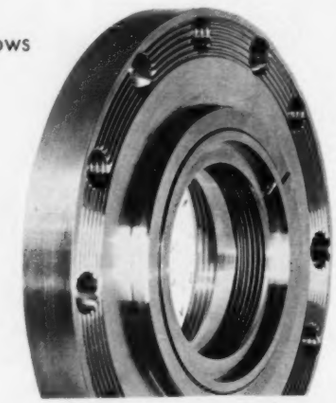


ANGLE BODY AND WELDED LEAF BELLOWS

VALVE APPLICATION FOR SINGLE SWEEP CONTOUR. Maximum operating pressure is 150 psi, maximum temperature 1000F, stroke ½-inch.



FLAT PLATE BELLOWS



ROTATING SHAFT BELLOWS SEAL. Diaphragms are flat-plate type which maintain constant effective area, thus properly balancing nose seal and bellows area through wide pressure range.

necessary or desirable. In general, the sketches show the amount of space that should be allowed for terminals. Diameter does not affect the thickness of the terminal except as deflection or structural requirements dictate.

Bellows Materials

The usual factors to be considered when making the choice of diaphragm material are:

Strength at operating temperatures
Corrosion resistance
Ease of fabrication
Availability

Performance characteristics of the bellows will sometimes limit choice of material. Those applications requiring good spring properties, zero drift, or those requiring low spring rates coupled with high pressure or long stroke will dictate heat-treated materials in order to obtain high physical properties.

In other cases, corrosion resistance or high temperature capabilities are determining factors. From the foregoing curves and charts, the design engineer can determine if his application requires a heat-treated bellows, a stainless-steel bellows or one made from the many remaining materials.

The most commonly used materials, and the ones inventoried in a wide range of thicknesses are:

300 Series Stainless Steels—347, 321, 316 LC or stabilized
Precipitation Hardening Stainless Steels—AM350, 17-7 PH
400 Series Stainless Steel—410

The second group is used for applications where the material's special characteristics are important. Inventory is not as complete as the first group.

Monel
K-Monel
Inconel
Inconel "X"
Hastelloy B
Hastelloy C
Ni-Span C

The third group of materials consists of the many super alloys available only by special order. (To be continued in an early issue of DESIGN NEWS.)

Design information presented in this article was provided by the Metal Bellows Corp., Wellesley, Mass. Illustrations were provided by Minneapolis-Honeywell Regulator Co.; Pacific Scientific Co.; Crosby Valve & Gage Co.; General Controls Co. (Hammel-Dahl Div.); North American Aviation, Inc. and Metal Bellows Corp.

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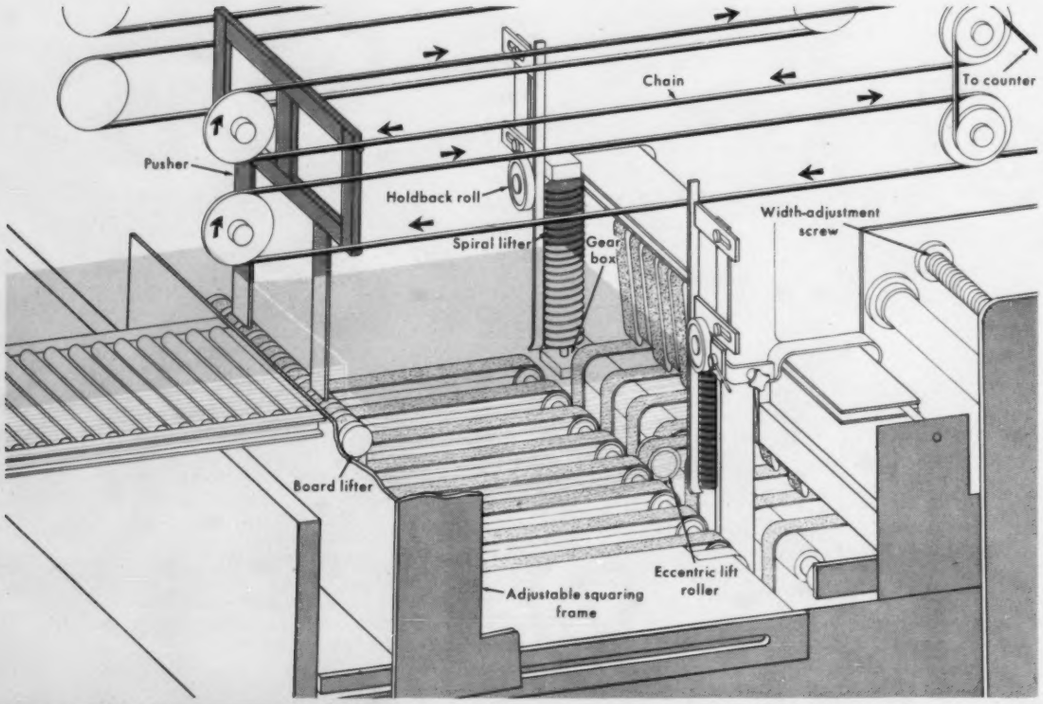
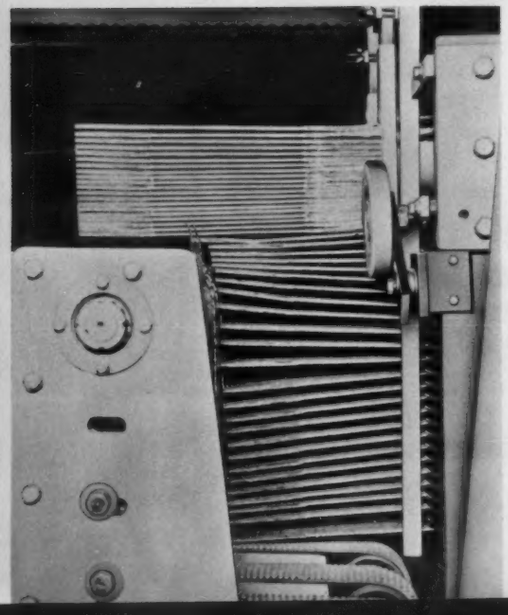
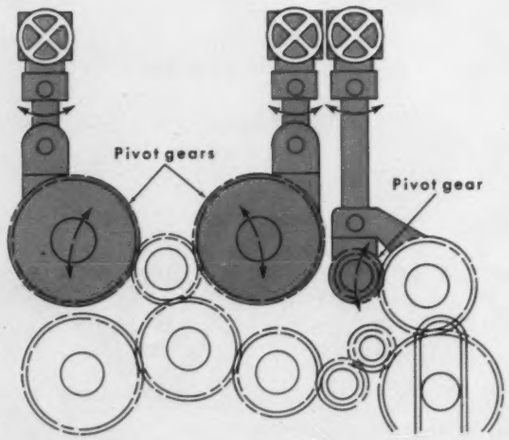
Spiral Lifters, Pusher Count Corrugated Boxes Mechanically

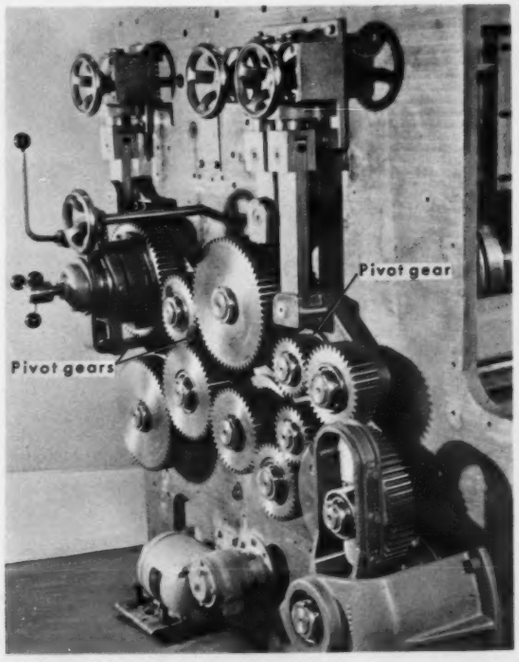
Victor W. Wigotsky, Eastern Editor



COMBINATION COUNTING AND SQUARING DEVICE is integral part of machine and utilizes spiral board lifters driven by mitre gears. Eccentric lift roller guides board from bottom hopper to driven spiral lift. Rubber holdback rolls control board slippage. Four roller chains, running parallel to box travel, drive pusher to sweep stack off top of hopper. Entire cycle of squaring, counting and ejecting is mechanically timed. Spiral lifters separate boxes to avoid scuffing and ink offset and square stack without extra handling. Chain drive can be adjusted to vary sweep time and thus stack size between 15 and 35 boxes.







GEAR TRAIN ADJUSTMENT provides constant mesh for varying box thicknesses. Rotation of worm and gear through handwheel adjusts linkage to move pivot plate attached to frame through pivot gear. Gear mounted on plate pivots about stationary gear center.

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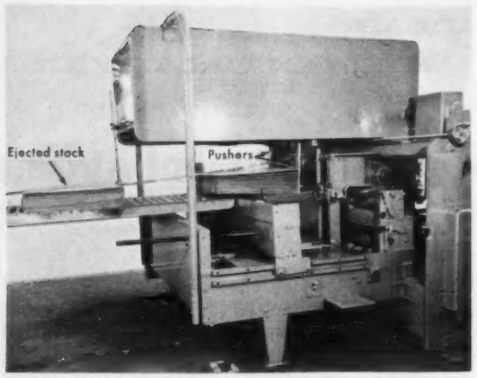


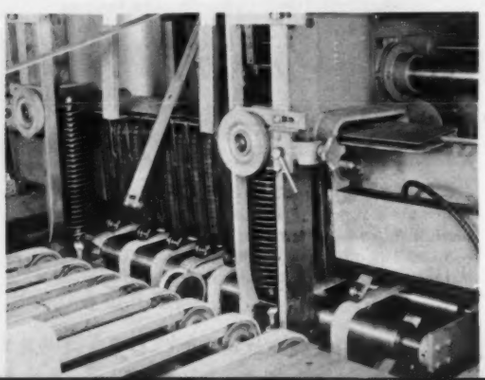
MACHINE CREASES, slots, rotary-die cuts, prints, folds, stacks and delivers squared piles of glued boxes in one pass. Up to 300 boxes per minute can be handled. Panels as small as 3¼ by 6 inches and box blanks up to 38 by 81¾ inches can be accommodated.

A pair of rotating lifters and a chain-driven pusher mechanically count corrugated boxes in a new multiple-function machine.

The spiral lifters pick up the boxes from an underfed hopper and progressively raise them in a stack. The chain-driven pusher, set to pick up a pre-selected number of boxes, ejects each stack to a gravity roller conveyor for bundling. The simple mechanical method provides counted stacks with minimum maintenance. A slapper plate and squaring belts, together with the double screw, assure proper squaring of the stack of boxes as it progresses upward.

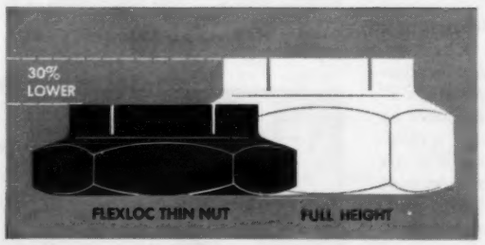
The machine also uses a simple pivot mounting system to provide a constant mesh gear train, in spite of variations in box thickness for different jobs. Pivot mounting was selected as a means of maintaining a constant center distance to hold the designed backlash. Eccentric mounting, on the other hand, as a means of adjusting roller gap would have resulted in excessive backlash, wear and noise. The gear pivot points can be adjusted to compensate for box thicknesses within a ⅛ to ⅜ inch range and thus correct the gap between the unit's feed rolls.

The Model ZLM automatic box making machine was designed by S & S Corrugated Paper Machinery Co., Inc., Brooklyn, N. Y.



SMALL WONDER: **FLEXLOC** THIN NUT

30% lower and lighter, yet still stays put for keeps!



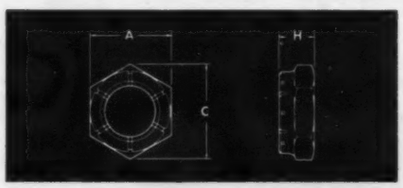
Frequently you need a smaller, lighter locknut, yet you can't afford to sacrifice one whit of holding power. That's where self-locking FLEXLOC thin nuts come in.

Since they are 30% lower than full height locknuts of the same diameter, FLEXLOC thin nuts allow you to design more compact bolted joints. They often fit into space where clearance is insufficient for standard height nuts. Also, thanks to minimum projection, they improve appearance and increase safety.

And FLEXLOC thin nuts save precious weight—they themselves are 30% lighter and you save additional weight by using shorter bolts or studs.

What about reliability? FLEXLOC thin nuts won't budge, even in the face of impact or vibration. This is because every thread, including those in the locking section, carries its full share of the tensile load.

FLEXLOC thin nuts also . . .



- Simplify design—1-piece fasteners (no auxiliary locking elements required)
- Save production time—fewer turns needed to seat
- Lock without seating—serve as stopnuts as well as locknuts
- Can be readily removed and repeatedly reused
- Available in stainless as well as alloy steel

FLEXLOC thin nuts come in sizes from #6 to 1½ in. For complete information, see your authorized SPS distributor or write Standard Pressed Steel Co. — manufacturers of precision threaded fasteners and allied products in many metals, including titanium—for Bulletin 2339. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 6, PENNSYLVANIA.

sps

where reliability replaces probability

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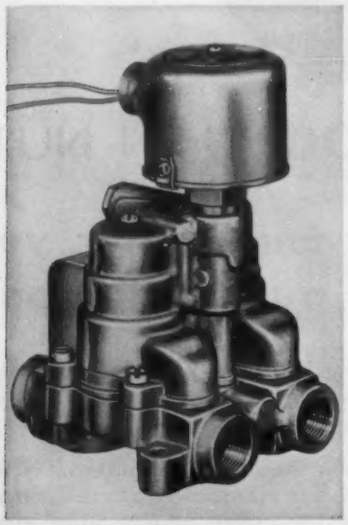
Why Name an Air Valve "Mach 2"?

"Mach 2" is the name of a new Crescent® Air Valve now ready for distribution to industry. An identifying name is desirable for this valve to point up the new kind of performance it brings to air control and to distinguish it from the other valves in the long-established Crescent® line.



The new Crescent "Mach 2" 4-Way Valve. (Half-inch pipe size shown.)

A Breakthrough in Cycling Speed

Actually these Crescent® "Mach 2" 3-Way and 4-Way Air Valves represent a breakthrough, as the name suggests. For years a cycling speed of 600 to 700 cycles a minute seemed to be the limit for solenoid pilot valves. The original Crescent 4-Way Valves attained that speed a long time before other valves even approached it. Now, the "Mach 2" has been tested and rated for 1000 cycles per minute continuous duty. During a two-hour test at a speed of over 1500 cycles per minute the coil temperature stabilized at 7°C below the maximum code limit for class A coils. Cycling speeds as high as 2100 have been successfully reached for intermittent periods of 20 minutes.

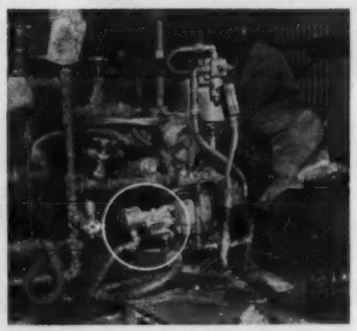
Brings New Dependability

We realize that such high cycling speeds are seldom needed. However, speed and endurance seem to be Siamese twins. Here's why: (1) Speed depends on an extremely short stroke of the solenoid plunger (3/32 of an inch—approximately the thickness of a nickel—in the new "Mach 2"). This greatly reduces coil heating and, as heat goes down, coil life expectancy goes up. (2) High cycling speeds demand a drastic reduction of friction in the solenoid and pilot valve section. In the "Mach 2" pilot valve, a tiny ball seats on "O" rings at both ends of a pilot cartridge. The ball moves freely, independent of the seals. There is no "O" ring drag on the pilot plunger because it requires no seals; where there is no friction there can be no wear.

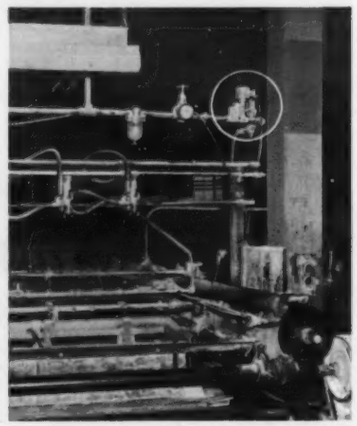
Similarly, the main valve seats seal on "O" rings. Metal shoulders take the shock in such a way that the "O" ring seal is merely kissed by the seat in the sealed position; since they are only minutely flexed they don't fatigue or lose their resilience.

100 Million Cycle Guarantee

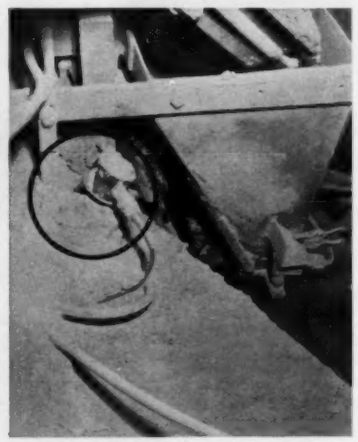
Because of the short solenoid plunger stroke and the elimination of friction, there seems to be no limit to the endurance of the solenoid coils in "Mach 2" Valves. We back up this statement by guaranteeing the coil life for a minimum of 100 million cycles. For six years "Mach 2" Valves have undergone test. Valves have been placed in some of the toughest applications we could find to test their performance capabilities in actual service before introducing them to the market. Some were installed in plants where they were subjected to very fast-cycling, continuous operation. Others have been operating where they are exposed to excessive dirt, dust and dampness, and in all cases the "Mach 2" Valves are performing flawlessly. In fact, some operators balked at having us remove them for inspection. To test the new waterproofing treatment of the "Mach 2" coils, one of the units was completely submerged in a container of water on April 26, 1959, and it is still functioning perfectly.



Crescent "Mach 2" 4-Way Valve on a roofing paper machine. This machine operates 24 hours per day, 7 days per week.



Large printing press used to imprint cardboard cartons. "Mach 2" 3-Way Valve controls spray nozzles which apply "offset spray." Production speed of this machine is 2000 cycles per hour.



This Crescent "Mach 2" 4-Way Valve operates the hopper doors at a cement batching plant. The valve has been operating at 1400 cycles per day surrounded by dry cement. We actually had to dig the cement away from the valve to get a picture.

Write for the "Mach 2" Catalog

Crescent® "Mach 2" Solenoid Pilot Operated Air Valves represent a significant breakthrough in "the cycling speed barrier" and in valve life and operating dependability. We hope you will approve of the unusual name, "Mach 2." We know you will approve of the low-cost, downtime-free performance the "Mach 2" will deliver on your tough jobs. Please write to Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, California, and request an advance copy of the "Mach 2" catalog.

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IDEAS . . .

MECHANICAL DEVICES

Whiffletrees Distribute

Edward W. Schrader, Western Editor

A series of whiffletrees, or weight distribution bars, divides the load to stretch a circular membrane. The basic purpose of these tests is to obtain an experimental load-deflection and deflection profile curves for the stretched circular membrane when it is subjected to a point load at its center. These curves are used to check the validity of the equations predicted by theory.

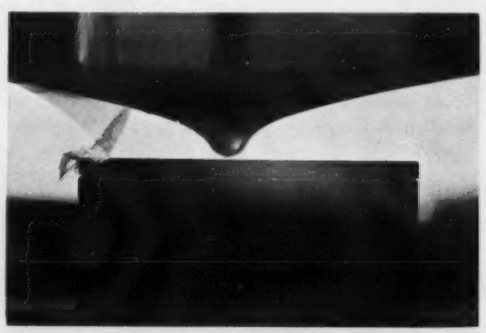
The device produces equal stress in the membrane in all directions. This simulates an isolated portion of the skin of an inflated balloon. The membrane is 0.0005-inch thick "Mylar".

Sixteen pulleys, located on a square wood frame lying in a horizontal plane, carry cords to the whiffletrees. The cords pull in a radial direction on the membrane.

After passing over the pulleys, each group of four-car cords is attached to the system of load-distributing bars. The main stem or cord of each of these four whiffletrees is attached to a weight. The whiffletree is arranged so that this weight is divided equally among the four cords.

One treadle actuates all four weights. Lowering the treadle causes the weight to rise off the ground. Half of the weight goes to the treadle, and half to the whiffletree and eventually to the membrane.

The basic research to be conducted on the membrane requires a 1/8-inch dia rounded rod be applied at right angles to the membrane surface.



PROFILE OF DEFLECTED MEMBRANE. Block beneath gives scale and horizontal axis. Portrait camera uses metallurgical instrument lens with 7.5 inch focal length mounted on end of 10-inch tube. With film 25 inches from lens, magnification factor is about 2.4.

Load in Circular Membrane Test

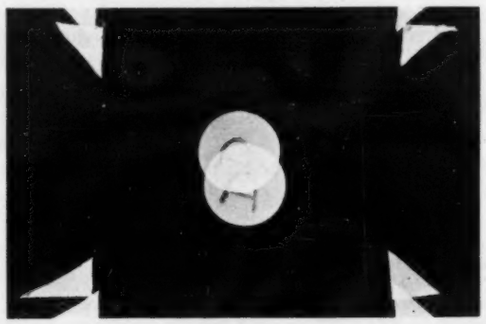
The deflection of the membrane is then to be measured.

A 20-inch dia membrane is first stretched to a known stress, then it is supported on a 10-inch dia ring. This supporting ring is attached to the frame by small cross beams and can be positioned horizontally and raised vertically by adjusting screws. The ring is raised so that it just touches the membrane.

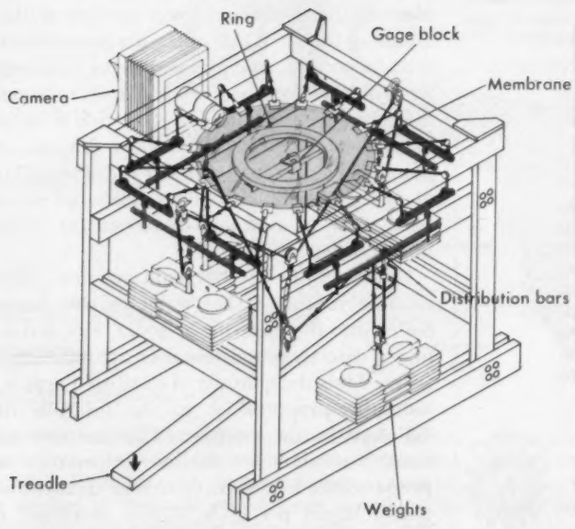
A second ring of the same diameter is placed over the first, so that the membrane lies between them. The two rings are then clamped together by eight C-clamps. The upper ring is equipped with a beam lying across its diameter. At the center of this beam, there is a hole of ⅛-inch dia through which the loading probe can slide. The probe is threaded at one end so that weights of different magnitude may be fastened to it.

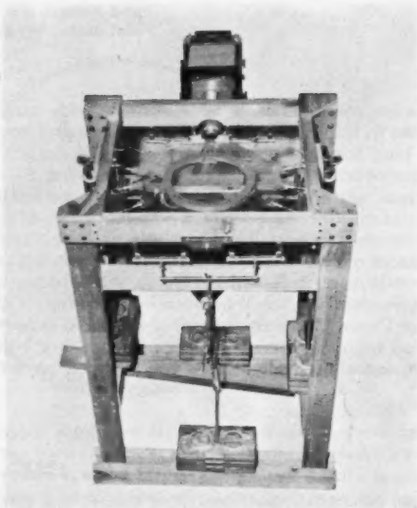
The tests are being conducted at various prestretch magnitudes, the largest being 7500 psi (isotropic stress). The probe loading is approximately 1 lb just prior to failure (punch through). At this load, the deflection of the membrane is about 0.75 inch at the center.

The test device is a design of the Missile Systems Div., Lockheed Aircraft Corp., Sunnyvale, Calif.



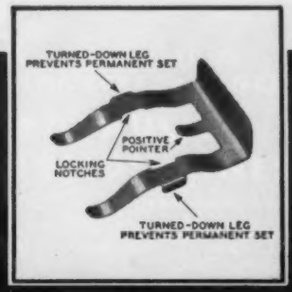
DOUBLE EXPOSURE taken with camera in vertical position can be measured to determine deflection of points before and after loading. Circle is for sample identification.





WHIFFLETREES distribute load on membrane in test frame. On each side of frame, weight distribution bars divide single dead weight into four equal loads. Total of 16 cords apply load radially to membrane over pulleys.

Like no other fastening device...



THIS EXCLUSIVE

CORBIN CLIP

saves time!
cuts costs!
never loosens!

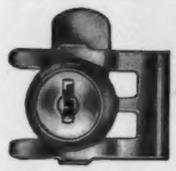
Made of tempered spring steel. Locks and snaps into place with an assuring click. An exclusive and patented design—different from any other—holds clip securely in place: notches on clip engage notches on cylinder . . . specially-designed legs on sides of clip absolutely prevent a permanent set.

No time-consuming, fumbling assembly operations. No special installation skills. Just a snap and the job's done—on 14, 16, 18, 20 and 22 gauge metal. Can be furnished for other gauge metal on special order. For complete details, write CORBIN.

Spring steel clip locks into fastening grooves.

Side view—clip holds lock firmly against metal.

Top view—clip cannot take a permanent set.



Clip in place on Corbin C15258 disc tumbler cam lock. Also available on other cylinder locks.

CORBIN

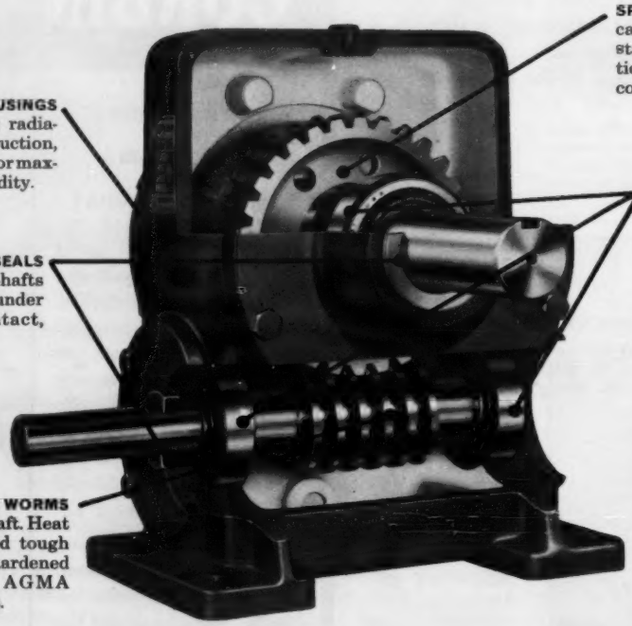
CORBIN CABINET LOCK DIVISION
THE AMERICAN HARDWARE CORPORATION
NEW BRITAIN CONNECTICUT

Circle 10 on Reader-Service Card for more information

Engineering Data

WINSMITH SPEED REDUCERS

WINSMITH "C" SERIES WORM GEAR SPEED REDUCERS



SPECIAL BRONZE WORM GEARS cast to recommended AGMA standards. Low coefficients of friction and thermal expansion for cooler, more efficient operation.

CAST IRON HOUSINGS designed for high heat radiation. One-piece construction, close-grained gray iron for maximum strength and rigidity.

TAPERED ROLLER BEARINGS for minimum maintenance, long bearing life, permanent shaft alignment. Capacity to handle high radial and thrust loads.

POSITIVE OIL SEALS keep oil in, dirt out. Shafts lapped to micro-finish under seals for uniform contact, longer seal life.

AVAILABLE in single and double reduction models, for intermittent or continuous service. Order from stock with right-angle or parallel shafts, worm on top or bottom, all worm gear or combined worm and helical. All types of special units also available.

CASE-HARDENED STEEL WORMS cut integral with the shaft. Heat treated for close-grained tough core, carburized and hardened before grinding. Meet AGMA long-wear specifications.

- *108 Models*
- *1/100 to 34 H.P.*
- *Ratios 5:1 to 4460:1*
- *Max. Output Torque 142 to 34,767 in. lbs.*

Winsmith "C" Series Reducers are compact units which offer a wide range of horsepower and torque output in minimum space. Their design and construction provides high shock load resistance; maximum thermal capacity without induced cooling; greater overhung load capacity; all moving parts totally enclosed in a dirt-proof housing and lubricated from a central oil bath; and complete interchangeability of major components. These features add up to smooth, trouble-free performance—an extremely low rate of wear—high mechanical efficiency—and greater overall economy per horsepower dollar.

For complete information on Winsmith Speed Reducers, write today or call your nearest Winsmith Representative. You'll find one in every major industrial area, listed in the Yellow Pages. They are technically trained experts who are always ready to help you with any speed reducer problem. For both standard and special power transmission applications, you'll find it pays to standardize on Winsmith.

WINSMITH, INC.

200 Eaton Street, Springville, (Erie County), New York

MEMBER OF AGMA

• • • Winsmith Speed Reducers are made by American craftsmen to meet American design and production standards.

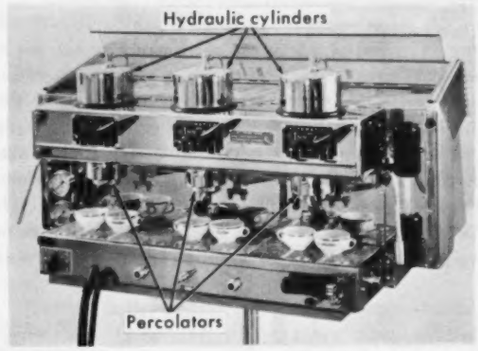
Circle 11 on Reader-Service Card for more information

IDEAS . . .

MECHANICAL DEVICES

Intermittent Tap-Water

Celestino O. Lubatti, Italian Editor



Operating water intermittently replaced from a main produces percolating force and proper cooling to maintain constant temperature in an "espresso-type" coffee machine. Heat from percolating water is transferred by metal parts to the operating water and carried away by outgoing water in the opposite section of the hydraulic cylinder. Since discharge frequency depends exclusively on the work rate, it is possible to keep infusion temperature at a constant 95C, regardless of the machine output.

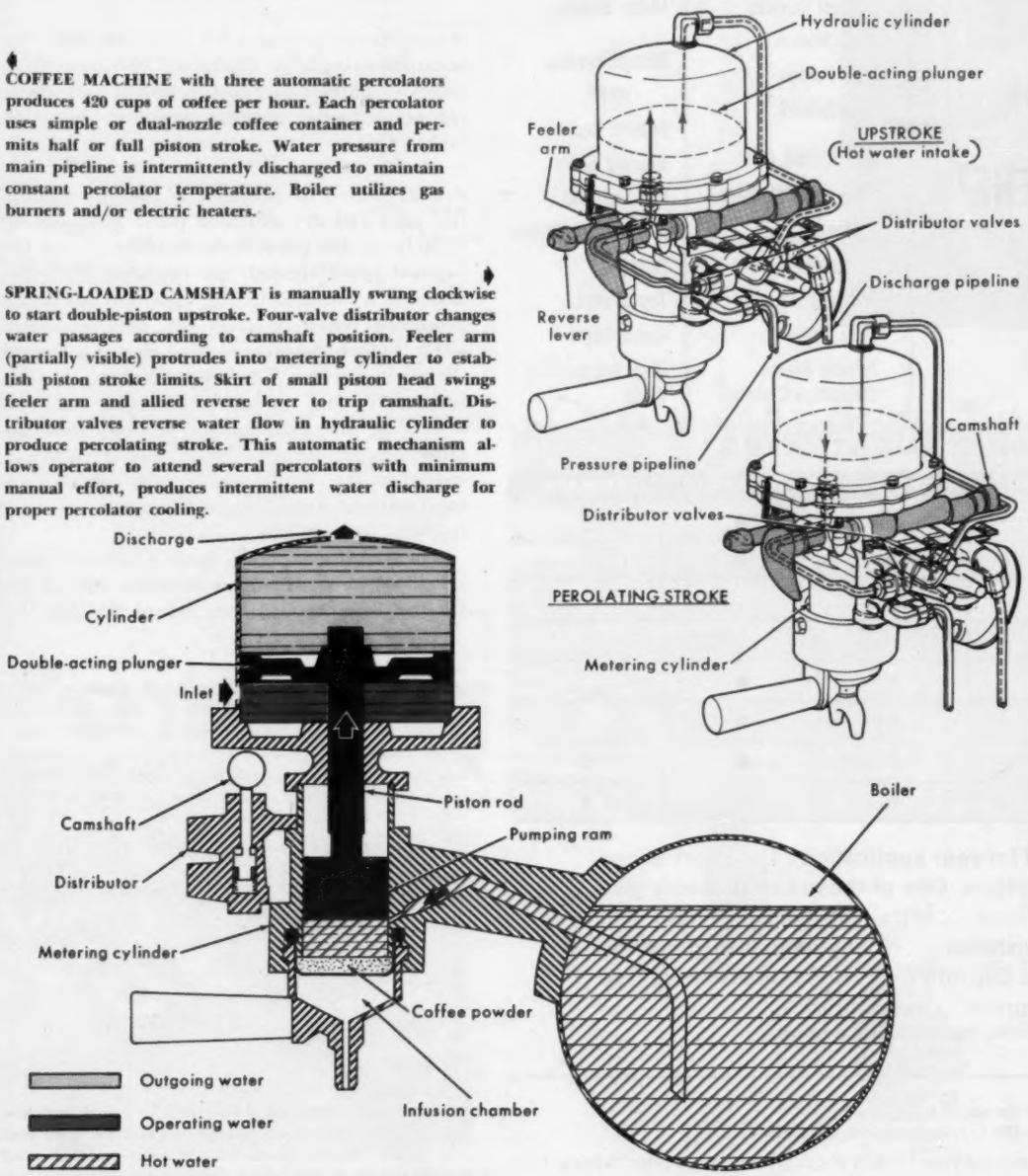
The double-acting plunger of a differential piston utilizes the pressure of cool water alternately entering the upper and lower sections of the hydraulic cylinder. While operating water enters one cylinder section, an equal volume of outgoing water dissipates a proportional quantity of heat from the other. Because alternating motion is necessary to meter and percolate hot water through coffee powder, the hydraulic cylinder is discharged twice in one cycle. This frequent discharge produces water flow in alternate directions for intensive heat transfer.

During upstroke the pumping ram allows a variable volume of hot water to pass from the boiler into the metering cylinder. Hot water volume is directly proportional to the incoming cool water. Thus the quantity of dissipated heat is substantially proportional to the infusion liquid delivered by the machine. This proportion prevents variation of infusion temperature when piston stroke is altered to change quantity of infusion liquid per cycle. Coffee machines using one or more perculators of this type are produced by Officine Cimbali Giuseppe SpA, Milan, Italy.

Discharge Steadies Percolator Temperature

COFFEE MACHINE with three automatic percolators produces 420 cups of coffee per hour. Each percolator uses simple or dual-nozzle coffee container and permits half or full piston stroke. Water pressure from main pipeline is intermittently discharged to maintain constant percolator temperature. Boiler utilizes gas burners and/or electric heaters.

SPRING-LOADED CAMSHAFT is manually swung clockwise to start double-piston upstroke. Four-valve distributor changes water passages according to camshaft position. Feeler arm (partially visible) protrudes into metering cylinder to establish piston stroke limits. Skirt of small piston head swings feeler arm and allied reverse lever to trip camshaft. Distributor valves reverse water flow in hydraulic cylinder to produce percolating stroke. This automatic mechanism allows operator to attend several percolators with minimum manual effort, produces intermittent water discharge for proper percolator cooling.



UPPER AND LOWER SECTIONS of hydraulic cylinder are alternately connected with main and to discharge. Operating water lifts double piston and withdraws excess heat from hot water supplied by boiler. At end of piston upstroke, 22-psi pressure from main drives down piston, causing hot water to percolate through ground coffee. Six-to-one surface ratio of piston heads boosts percolating pressure to 132 psi. This insures complete absorption of soluble components. Chromium-plated brass parts forming cylinders and double piston transfer heat from hot water to cool water. Since volume of cool water discharged during each percolating cycle is proportional to volume of hot water percolating through coffee powder, temperature of infusion liquid remains substantially constant.

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IN HYDRAULIC TRANSMISSION LINES

Anchor Pressed-On Couplings for high, medium and low pressure hose assemblies.

Anchor 4-Bolt Split-Flange "O" Ring Couplings for high, medium and low pressures.

Anchor Reusable Couplings—Regular or Clamp Type—for high, medium and low pressures.

Anchor Adapter Unions, Pipe Fittings, and SAE Boss Type Fittings for wide range of applications.

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ANCHOR COUPLING CO. INC.

390 North Fourth St., Libertyville, Ill.

Branch Plants: Dallas, Texas; Plymouth, Mich.

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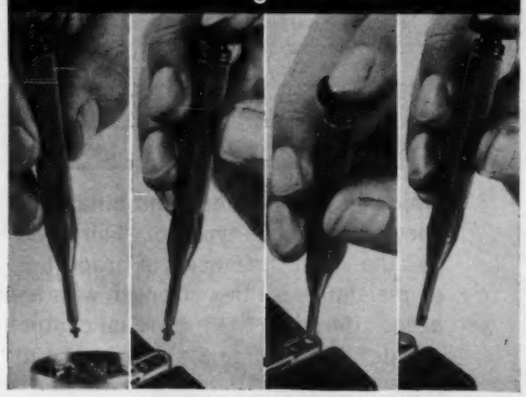
FASTER Handling of TINY Screws



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AUTOMATIC SCREW-HOLDING DRIVER

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Is there an idea here for you?

Du Pont combines elastomers with fabrics to make versatile FAIRPRENE® —a design material of many uses

Here's how "Fairprene" is serving industry:

Diaphragms for:
Carburetors
Compressors
Control Devices
Flow Meters
Fuel Pumps
Distributors

Fabricated into:
Pneumatic Shelters
Radomes
Tarpaulins
Air Foams
Fuel Bags
Missile Blast-Deflection Curtains

Molded into:
Pump Cups
Packings
Meter Bellows

Miscellaneous uses:
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Bearing Seals
Fire Curtains
Microphone Covers
Gaskets
Top Sheets
Water Seals
Dielectric Sealing Vents

COATING	FABRIC SUBSTRATES				
	COTTON	NYLON	"DACRON"	GLASS	"TEFLON"
NEOPRENE	●	●		●	
BUNA-N	●	●		●	
"FO"	●	●			
BUTYL	●	●			
"HYPALON"**		●	●	●	
ACRYLIC			●	●	
SILICONE			●	●	●
"VITON"**			●	●	●

Which elastomer-fabric combination is best for your application? The chart above shows the various types of "Fairprene"* available. One of these can probably give you the exact "balance" of properties you need . . . extra-high burst strength with oil resistance . . . flex strength with heat resistance . . . or any degree of the properties offered by the individual components. Clip and mail coupon below for a free booklet giving complete details about "Fairprene" coated fabrics.

*"Fairprene" is Du Pont's registered trademark for its coated fabrics, sheet stocks and cements.
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INDUSTRIAL COATED FABRICS
SHEET STOCKS · CEMENTS

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BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Division DN-1, Wilmington 98, Delaware

Please send me your booklet about "Fairprene" coated fabrics. I am interested in using a coated fabric for_____

Name_____ Title_____

Firm_____

Address_____

City_____ Zone_____ State_____

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IDEAS . . .
MECHANICAL DEVICES

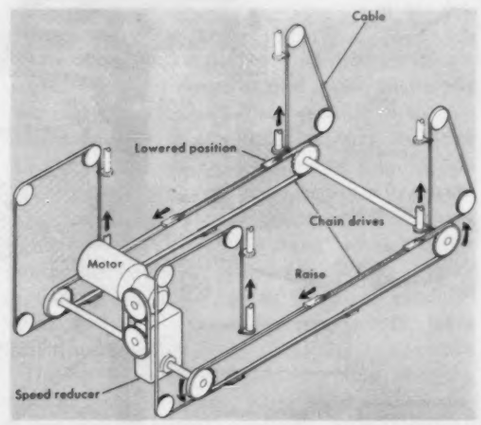
Chain, Cable Coordination

Lars G. Soderholm, Midwest Editor

A continuous photographic processor uses two interconnecting roller chains and four connecting cables to provide four-corner raising and lowering of the roller assembly into the processing tanks. This provides precise positioning using a minimum of space.

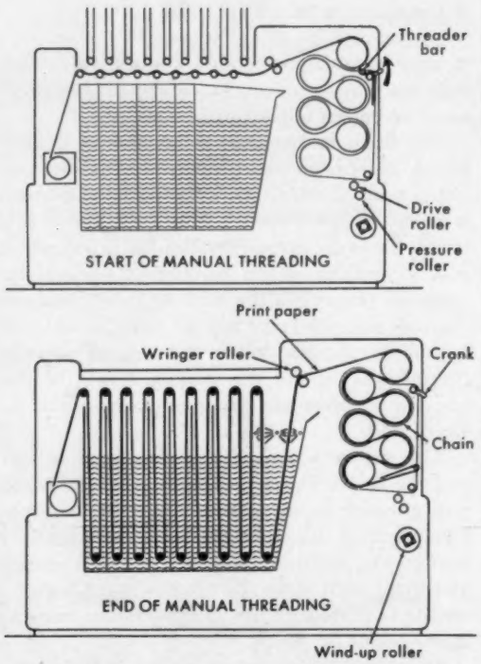
The continuous processor is used to develop, fix, wash and dry sensitized paper at speeds up to 30 linear feet per minute. In order to start the exposed paper through the machine, the roller assembly is raised to its "up" position out of the processing tanks. A leader can then be drawn easily through the processor and threaded around the drying drums. The roller assembly is then lowered, forcing the leader into the tanks and sealing off that section of the processor that contains light sensitized metal. A "Mylar" leader is spliced to the trailing end of each roll of sensitized material, automatically leaving the processor threaded for each run.

The continuous photographic processor is manufactured by the Paragon Revolute Div. of the Charles Bruning Co., Inc., Mount Prospect, Ill.

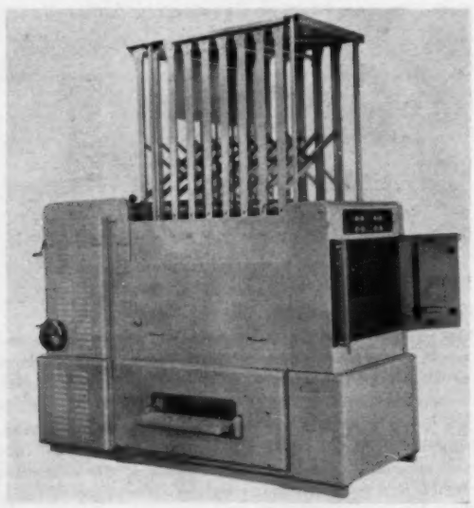


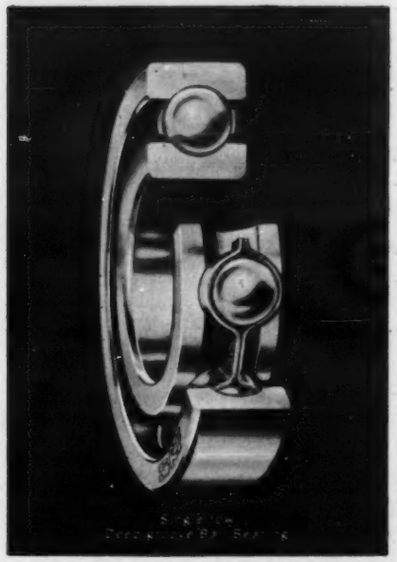
SUBMERGED ROLLER ASSEMBLY is raised and lowered through mechanical linkage operated by ¼-hp electric motor. Electric motor is connected by chain and sprocket drive to 30:1 speed reducer. Speed reducer output shaft drives two horizontal chain drives parallel to each other. Four connecting cables, each attached to top or bottom sections of the two chain drives, pass over series of pulleys and down to bottom of steel tubes at four corners of roller assembly. Limit switches control amount of chain drive travel to give either raised or submerged position.

Provides Four-Corner Lift



THREADER BAR is attached to roller chain which is wound about sprockets to give it path through drying rolls. To thread 'Mylar' leader, (which is done first time only) leader is wrapped around threader bar and hand crank turned to move threader bar and leader through drying rolls. Series of six drying drums give total of 15,000w of heat over total distance of heating drum surfaces.





Can a standard bearing offer you "more bearing" for your money?

It can if it's made by SKF—because all SKF bearings, both ball and roller, offer special qualities at "production" bearing prices.

Take the single-row deep-groove ball bearing featured here, as an example. SKF designs and builds this type to sustain heavy radial load and thrust load in either direction. Furthermore, it is engineered to run smoothly and quietly at normal speeds with grease lubrication—and at high speeds with oil.

Yet this is a standard SKF ball bearing, mass-produced by automated production equipment at our plant at Altoona, Pa. You can quickly get this bearing in over 100 sizes, ranging from 5/8" to 15.748" O.D., and in a variety of seal, shield and snap-ring combinations.

But why not find out what SKF offers in bearing quality, availability and economy? Just call the SKF branch office nearest you.

6001

Spherical, Cylindrical, Ball, "Tyson" Tapered and REED Miniature Bearings
EVERY TYPE—EVERY USE
SKF
SKF INDUSTRIES, INC. PHILADELPHIA 32, PA.

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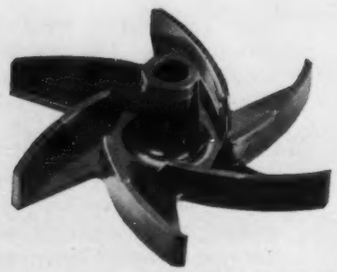
PRODUCT-DESIGN BRIEFS FROM DUREZ

- Phenolic for pumps
- Dip-coating compounds
- Plastic process equipment



FLINT & WALLING MFG. CO., INC.

Why not?

Here's a good way to engineer more profit into a pump.

The impeller is phenolic. It won't rust or corrode; it defies stubbornly the onslaughts of acid, oil, alkali, and soap.

A cubic inch of molded phenolic costs much less than you'd allow for a more traditional impeller material. Forget about machining; phenolic parts seldom need any.

If a pump must handle liquids as hot as 300°F, don't let that stop you from specifying phenolic.

We can work with your molder on the application you have in mind. Why not write us about it? Or simply check the coupon for Bulletin D400. It lists the properties of a typical Durez phenolic molding compound used in pumps, and includes much other useful information.

Coat for components

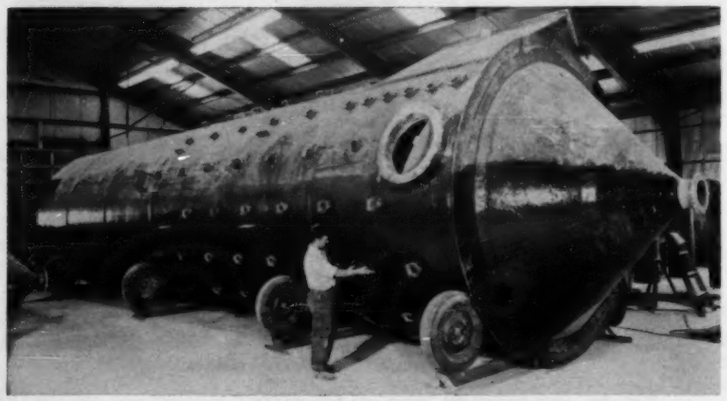
Looking for a simple encapsulating idea? Here's one that works well at heatproofing, moisture-proofing, and preventing shorts in small electrical components. It's non-messy, too.

Dunked in a paste coating, dried, then baked for a short time, components steadfastly resist extremes of heat and moisture that would otherwise raise havoc with their electrical reliability.

Components so coated can be soldered into a circuit without causing the coating to melt or peel. It won't soften, and easily passes a series of −55 to +85°C cycles. One thousand hours at a sweltering 150°C will turn the coating almost black but still won't materially affect the component inside.

The paste is made with Durez phenolic resin-and-filler compounds supplied in powder form. There's a choice of densities and toughnesses. One type is impervious to ketone solvent cements sometimes used in assembling radio and TV chassis.

What can these dip-coating compounds do for you? We'd like to help you find out. Write for more detailed information.



FABRICATOR: DU VERRE, INC., ARCADE, N.Y.

What's your big idea?

Think big. A 50-foot plastic boat . . . a 150-foot plastic radome . . . or a plastic chemical scrubber like this behemoth designed and sold by Buffalo Forge Co.—all are actualities today, with an assist from glass-reinforced Hetron® polyester resin.

The scrubber is expected to save someone a lot of money. In corrosive situations, Hetron has repeatedly proved it can outlast other commonly used materials by a factor of two, three, or more. First cost can be as low as one-third that of other special corrosion-resistant materials.

There's one other important point: safety. Hetron is inherently self-extinguishing. It retards fire because of its unique molecular configuration. Often, a Hetron installation—whether it's ducts, fume hoods, tanks, stacks, or blowers—can obviate the need for a sprinkler system.

If you'd like to know what the process-equipment fabricators are doing nowadays with this versatile, safe polyester, use the coupon. We'll gladly send you a data file on Hetron, including a list of leading fabricators who can shape it to your specifications.

For more information on Durez materials mentioned above, check here:

- ☐ Phenolic molding compounds (8-page Bulletin D400)
- ☐ "Phenolic Resin Compounds for Dip-Coating"
- ☐ Hetron polyester resin (data file and list of fabricators)
- ☐ "Durez Plastics News" (a review of current plastic applications, mailed bimonthly)

Check, clip and mail to us with your name, title, company address.
(When requesting samples, please use business letterhead)

DUREZ PLASTICS DIVISION
2101 WALCK ROAD, NORTH TONAWANDA, N. Y.
HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

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IDEAS . . .
MECHANICAL DEVICES

Diaphragm Control Valve

E. J. Stefanides, Central States Editor

A new diaphragm-operated control valve uses only one moving part to provide on-off control of up to seventeen outlet ports.

The single moving part is a rubber or flexible plastic diaphragm which operates on a differential pressure principle. One side of the diaphragm is exposed to the control pressure. The other side is exposed to the pressurized fluid or fluids, which it is controlling. When the control pressure exceeds the pressure of the working fluid, inlet and delivery ports in lower half of valve are shut off by the diaphragm. When the control pressure drops below that of the working fluid, the diaphragm uncovers and connects the inlet and delivery ports.

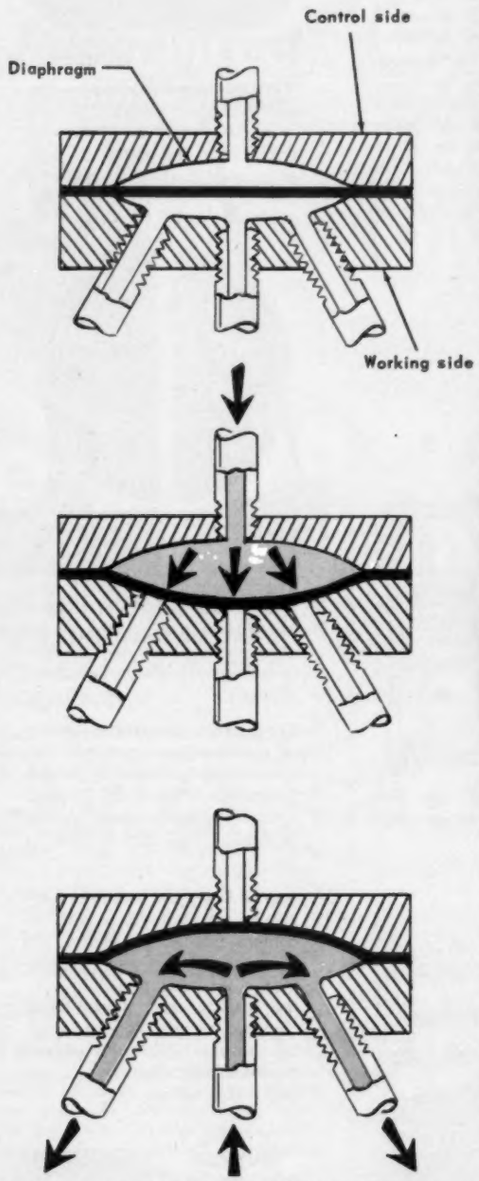
This device was originally developed to control the delivery of a highly abrasive and corrosive grinding slurry recirculated in a multiple-lens grinding machine. It is now available in a number of different combinations of housing and diaphragm materials to allow handling of a variety of problem fluids at temperatures ranging from —100F to 500F.

An interesting design feature is the use of a modified sine-curve profile (extended base) for the sealing faces. This causes a wiping action across the ports as the diaphragm seats, which dislodges foreign particles and helps assure a good seal.

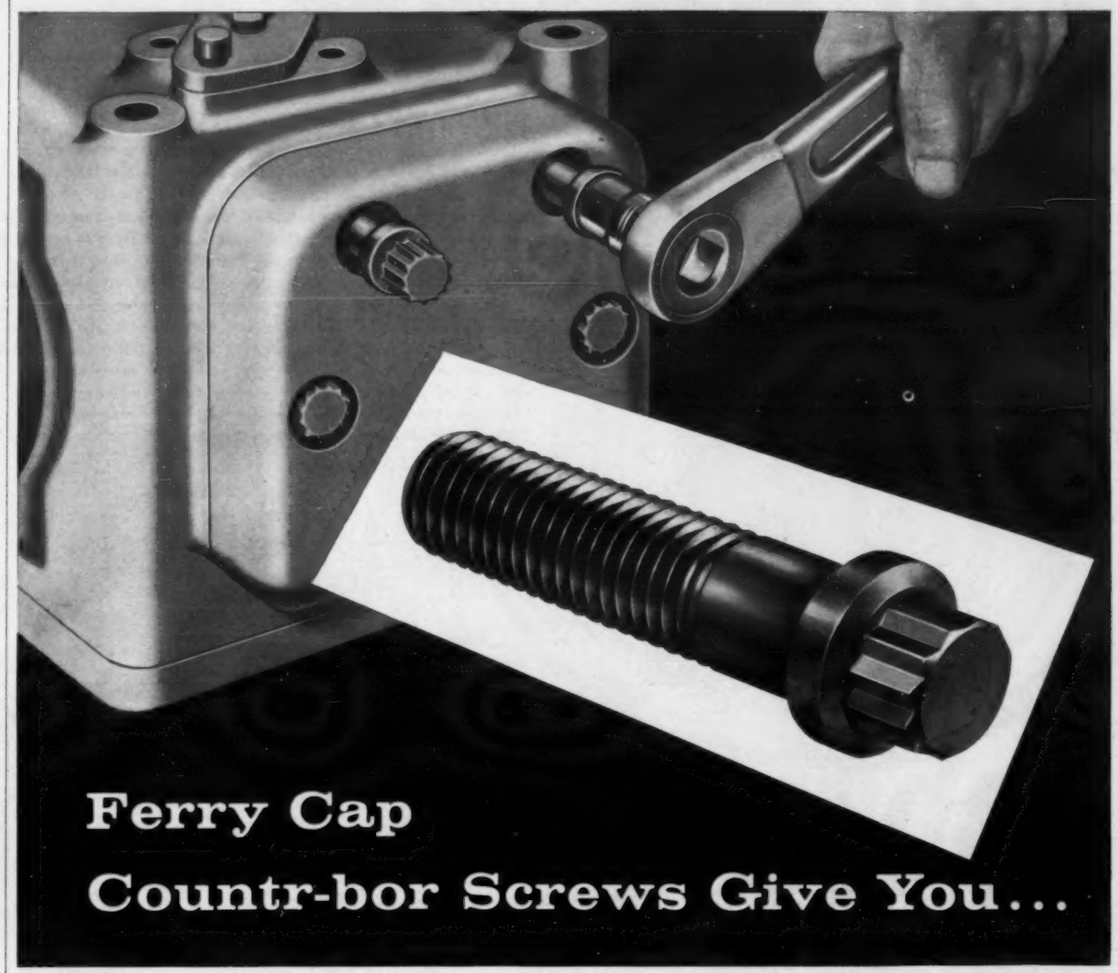
This control valve is designed and manufactured by the Frankel Engineering Laboratories, Inc., of Reading, Pa.

DIFFERENTIAL-PRESSURE MANIFOLD VALVE can be used for single-inlet, multiple-outlet, on-off control or with multiple inlets to combine on-off control with mixing function. Control pressure may be variety of liquids or gases. Working side may be pressurized gases, liquids or slurries. Device can be used for both pressure and vacuum service in operating range of from 10^{-6} mm Hg to 1000 psi. Minimum required operating differential is 1 psi, maximum 150 psi.

Has Only One Moving Part



SEQUENCE OF VALVE OPERATION. Top view shows valve with zero pressure condition on both sides of diaphragm. In operation higher pressure on control side displaces diaphragm downward, sealing off both inlet and outlet ports. In closed condition diaphragm is dimpled inward at the port. When control pressure is reduced, working fluid pressure lifts diaphragm off inlet port.



Tighter Wrenching...Faster Assembly
Up to 20% Purchase Cost Savings

Every time you use Countr-bor Screws you improve your products *and* save both time and money. Made of high-strength alloy steel, Countr-bor Screws fit in standard counterbored holes . . . tighten with standard socket wrenches . . . cost up to 20% less than regular socket head cap screws.

Countr-bor Screws wrench down faster *and* tighter because they have 12 external gripping points . . . 3 times the gripping surface of internally wrenched socket head screws. Without the usual gaping hole of socket heads, Countr-bor Screws look better, too. Countr-bor Screws can also save you money for flat surface applications where clearances are tight.

Countr-bor Screws are available in sizes from ¼" through 1". Special sizes, threads and materials are available on order.

Start saving now . . . send for free test samples of any desired size.

Ferry Cap & Set Screw Company
2151 Scranton Road, Cleveland 13, Ohio

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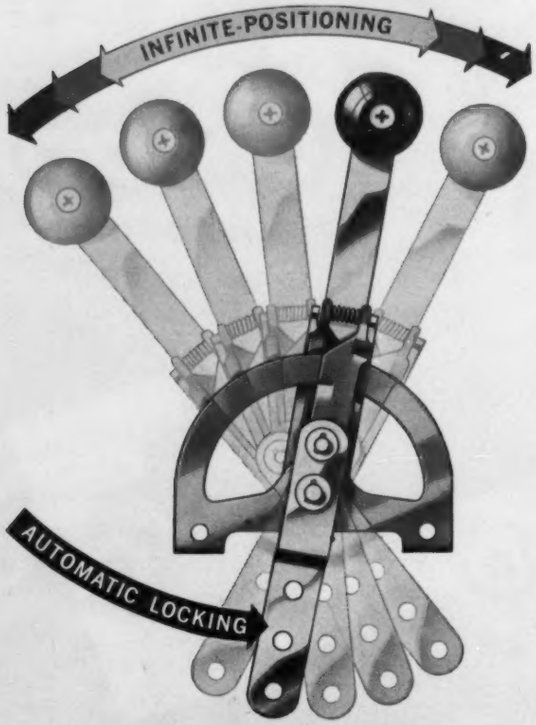
the ADAMS RITE QUADRASTAT CONTROL



APPLICATION:

...wherever positive control and automatic self-locking are required.

The Adams Rite QUADRASTAT Control employs a self-locking principle which permits infinite-positioning through use of the primary handle, but absolutely prevents any creepage or change of setting due to vibration or "feed-back" forces acting through the driven or actuating lever.

Uniquely engineered and comprised of only 5 main elements, the sturdy but lightweight QUADRASTAT is presently in trouble-free use on a wide range of control operations. It has been successfully incorporated into such diverse applications as tractor throttles, hydraulic valves, governors, air ducts, power boats, jet engines, and aircraft drag-brakes. The versatile unit may be manually, hydraulically, or motor controlled, and is available with handle, actuating lever, and quadrant mounted in various positions.

To learn how the QUADRASTAT can solve your control problem, write today for complete details and specifications, Department A-3.

"Over half a century"

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MANUFACTURING COMPANY
540 West Chevy Chase Drive
Glendale 4, California

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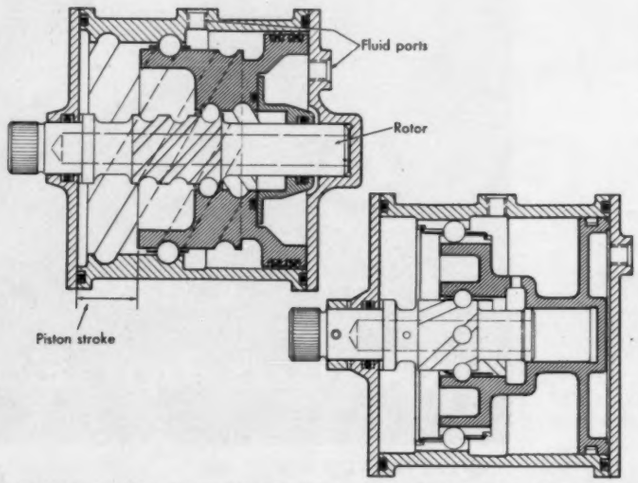
IDEA MART

AVAILABLE

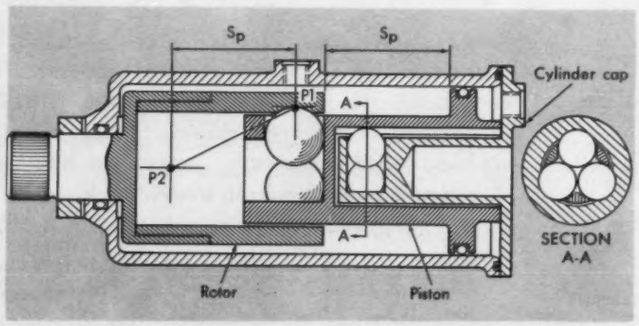
Piston-Operated Rotor

Rotor has four left-hand grooves to hold four balls inside piston with matching grooves (left-hand) inside piston. Periphery of piston and inside of housing have similarly matching right-hand grooves at 90 deg to hold four outer balls, as shown. Rotor has slight axial clearance, and in example design (below) turns 360 deg with piston stroke shown.

Ball retainers are cylindrical and may have length so that stop at each end of stroke keeps balls properly located. Piston rotates 180 deg inside housing; outer balls rotate 90 deg, and rotor moves another 180 deg. Fluid ports have alternate flow. Increasing stroke increases torque output. Pitch variations are unlimited and either set of balls may be in grooves parallel to axis. Write W. E. G., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



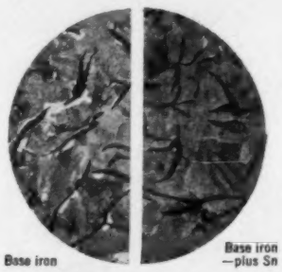
NONROTATING PISTON design for less than 360 deg turn of rotor, such as 90 deg in this embodiment. Means for one piston seal and full area pressure on each side of piston is also shown.



LONG-STROKE, HIGH-TORQUE ROTOR is used where high-pressure fluid is available. Three balls nest in to fit grooves in rotor. These grooves (for 90-deg rotation) have pitch P_1 to P_2. Cylinder cap has three balls nesting against each other and fitting axial grooves in piston so that piston cannot rotate. These grooves may have pitch if desired. Each may rotate 45 deg.

Straits Tin Report

Tin reduces wear—The addition of up to 0.1% tin has a marked effect in eliminating ferrite from the matrix of both gray and nodular irons, producing a wear-resistant fully pearlitic matrix.



Effect of tin on pearlite in microstructure of hypo-eutectic cast iron bar, 1.2-in. dia.

The amount of tin added to cast iron sections up to 3 in. thick is not critical. A reasonable excess does not produce any massive cementite or affect mechanical properties.

Organic compounds of tin stabilize vinyl chloride polymers to inhibit color at high temperature and to protect against decomposition during processing and degradation in service.

Low linear contraction is a property of high tin content die-casting alloys. Tin alloys shrink very little, permitting close tolerances and very thin walls in such typical small castings as pinions, numbering machine wheels, dashpots of electrical instruments, and gas meter grid valves.

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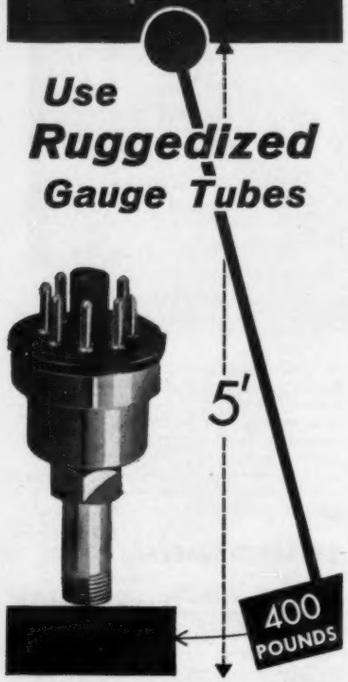
HASTINGS VACUUM GAUGES



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Ruggedness is *defined as* "strong, sturdy, hardy". But ruggedness is *demonstrated* by this shock test of a Hastings Gauge Tube conducted to government specification MIL 901B. A 400 lb. drop hammer was released to apply shocks to the above pictured Gauge Tube in all three planes from 1, 3 and 5 feet. The Hastings Gauge Tube remained unharmed and fully operable.

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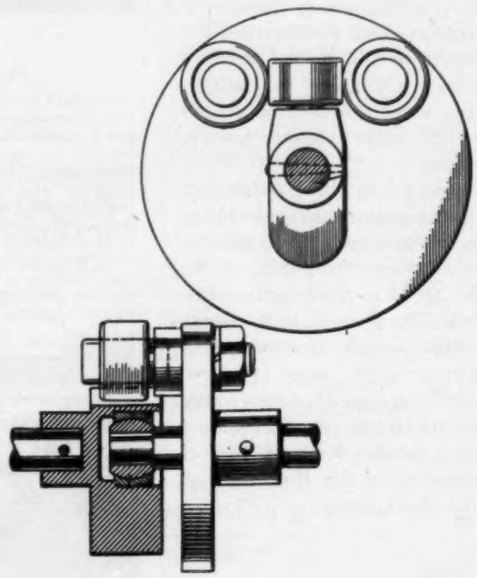
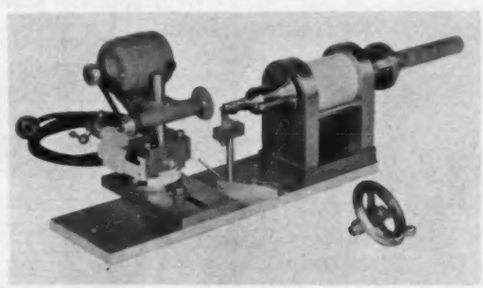
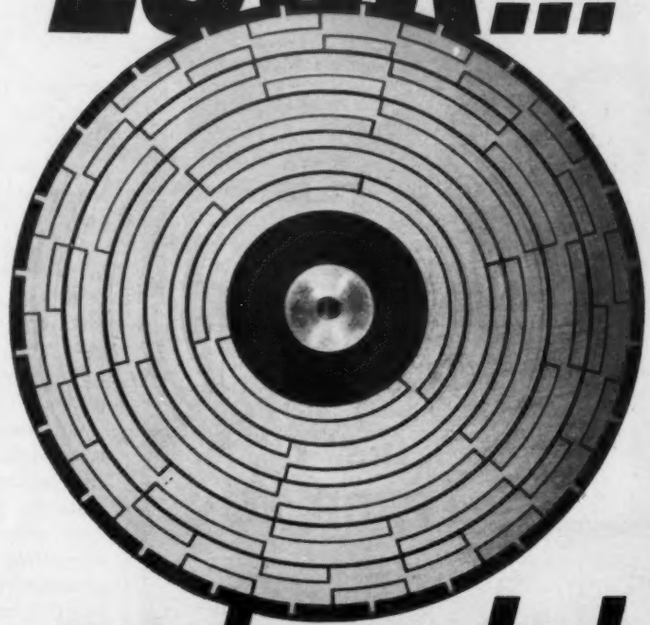


Portable Tool Grinder

End mill cutters are held with collets while grinding. Horizontal milling cutters can be sharpened with the use of a stub arbor. Many other small grinding jobs can be done also. Dimensions of the portable grinder are 6 by 7 by 20 inches. Wish to license manufacturing and distribution rights. Write H. W. E., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



LOOK...



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. . . or any code your computer, control system, or data processing device needs to keep it properly in touch with the world of real time.—A. W. Haydon is a company of infinite variation when it comes to such analog-to-digital converters, or "binary encoders". Time periods range from seconds to weeks. Sizes range from miniature to large. They come sealed, enclosed or open, with AC, DC, or pulse drive, and with an imposing variety of accessory equipment.—The model shown is for commerical use. It provides a discrete signal for each two-minute interval over a 28-day period. It is used, among other places, in an automatic parking lot ticket computing system.— This and several other time code generators are described in Technical Brochure SP9-2. It's yours for the asking. Similar solid-state devices can be supplied by our Culver City, Calif., facility.

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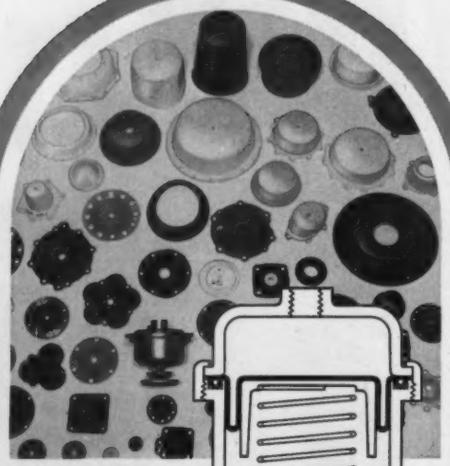

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PATENTS

Non-Skid Brake Control

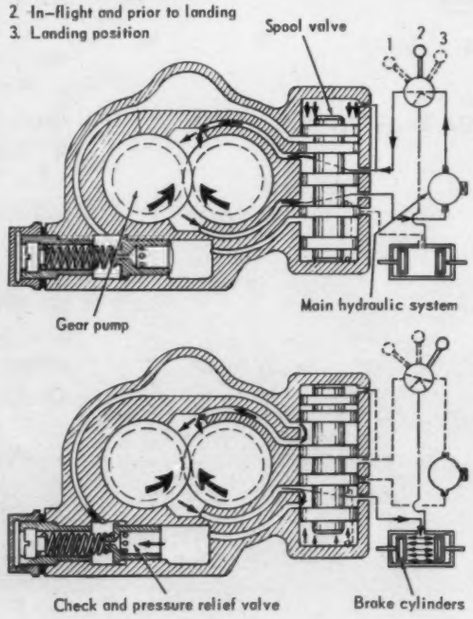
French Patent 1,223,756; VEB Industiewerke Karlmarx-stadt, East Germany.

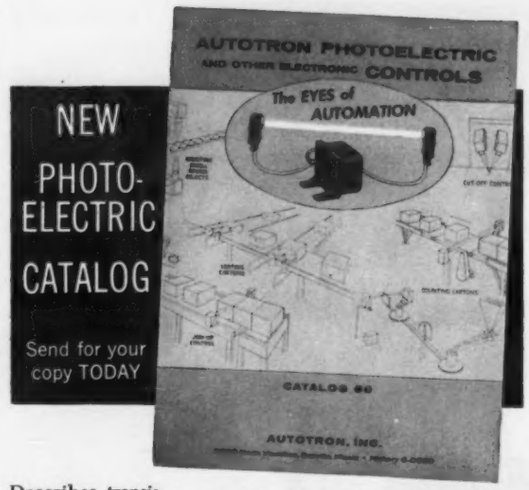
Designed to provide a non-skid system for aircraft, this invention uses a gear pump driven directly by a plane's wheels. This pump is connected to the aircraft's hydraulic system and to the brake cylinders. Two valves control the device.

Prior to landing (Fig. 1), the control lever on one valve is placed to admit pressurized fluid from the main supply to the second valve, a spool type. This piston is displaced and admits oil to the gear pump, which acts as a motor and rotates the wheels. The brake cylinders are cut off and at zero pressure.

On landing, compression of the landing gear cuts off the fluid pressure from the general circuit by turning the rotary valve to the right. With no pressure acting on the piston of the spool valve and with the gear pump actuated by the rolling wheels, this piston moves to the upper position (Fig. 2). Oil pressure from the gear pump is now admitted to the brake cylinders, but remains governed by the speed of rotation of the wheels. Brakes are always released before being blocked. Brake pressure is never zero, as its minimum corresponds to the flow through the small hole in the check valve.

1. Ground braking position
2. In-flight and prior to landing
3. Landing position





Describes transistorized and conventional photoelectric controls — normal, high speed, ultra sensitive and impulse actuated controls — photoelectric timing controls — complete line of light sources — including many protective features.

Simplified application diagrams cover widely varied requirements such as automatic control of conveyors; inspection, sorting, die protection, counting, weighing, limit control, car washing control, piling to exact count, safety control, conveyor traffic and jam-up control, timing control, spraying automation, automatic ramp traffic control.

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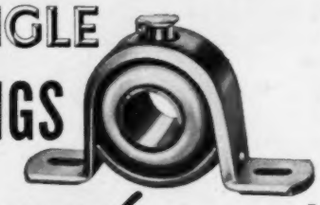
TRIANGLE **BEARINGS** with *Engineered* **INDIVIDUALITY**



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The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

DEVICE FOR CONVERTING LINEAR TO ROTARY MOTION
U S Patent 2,966,061; James T. Courtney, assignor to Carol R. Metcalf, Malibu, Calif.

REVERSIBLE TRANSMISSION SYSTEM
U S Patent 2,966,067; Reinhold Sommer, assignor to VEB Schlepperwerk Nordhausen, Nordhausen, Harz, Germany.

MOTION CONVERSION UNIT
U S Patent 2,966,069; Ralph H. Wise, assignor to The Anderson Co., Gary, Ind.

VISCOUS TORSIONAL VIBRATION DAMPER
U S Patent 2,966,074; Rollin Douglas Rumsey, assignor to Houdaille Industries, Inc., Buffalo, N. Y.

DIFFERENTAL DRIVE MECHANISM
U S Patent 2,966,075; Irving O. Howich, Los Angeles, Calif.

OSCILLATORY ACTUATOR
U S Patent 2,966,144; Richard E. Self, assignor to C. L. Norsworthy, Jr., Dallas County, Tex.

SILENT CAM FOLLOWER
U S Patent 2,966,152; Donald C. Wride, So. Australia, Australia.

FLUID TEMPERATURE-PRESSURE RELIEF VALVE
U S Patent, 2,966,164; Jack A. Britton, Lakewood, Ohio.

TEMPERATURE COMPENSATED METERING VALVE
U S Patent 2,966,170; George M. Raulins, assignor to Otis Engineering Corp., Dallas, Tex.

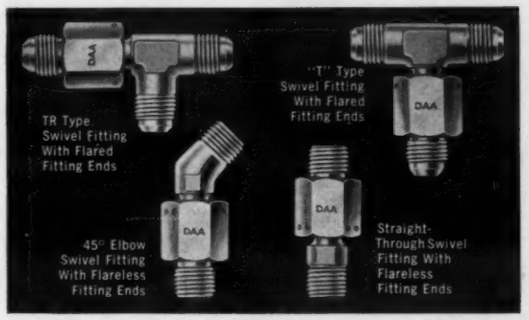
AUTOMOTIVE SPEED CONTROL DEVICE
U S Patent 2,966,224; Ralph R. Teetor, assignor to Perfect Circle Corp., Hagerstown, Ind.

AUTOMATIC BRAKE
U S Patent 2,966,240; John R. Aude and Newton I. Potter, assignors to Wehr Steel Co., Milwaukee, Wis.

CLUTCH AND BRAKE UNIT
U S Patent 2,966,245; Edward E. Judge, Sr., assignor to Industrial Metal Products Corp., Lansing, Mich.

OVERLOAD RELEASE CLUTCH
U S Patent 2,966,247; Jack Bryer, assignor to R. Hoe & Co., Inc., New York, N. Y.

SELF ALIGNING SWIVEL FITTINGS FOR **ANY ANGLE**


TR Type Swivel Fitting With Flared Fitting Ends
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DAA

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PATENT APPLIED FOR

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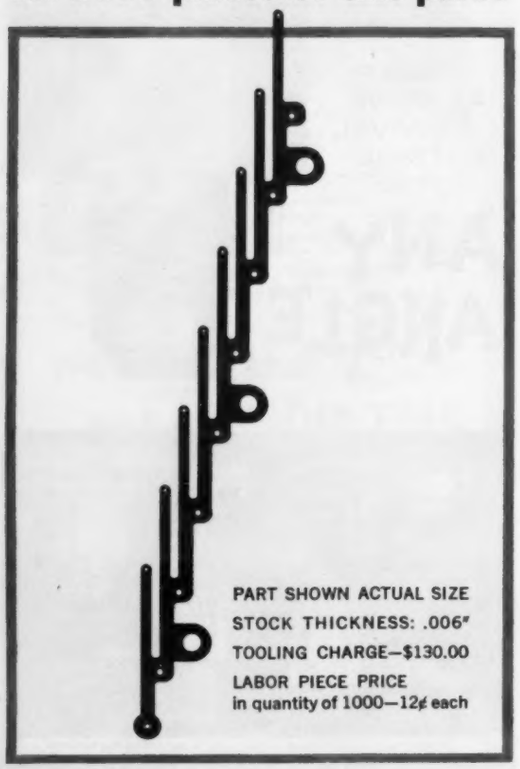

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DESIGN IDEAS NEWS

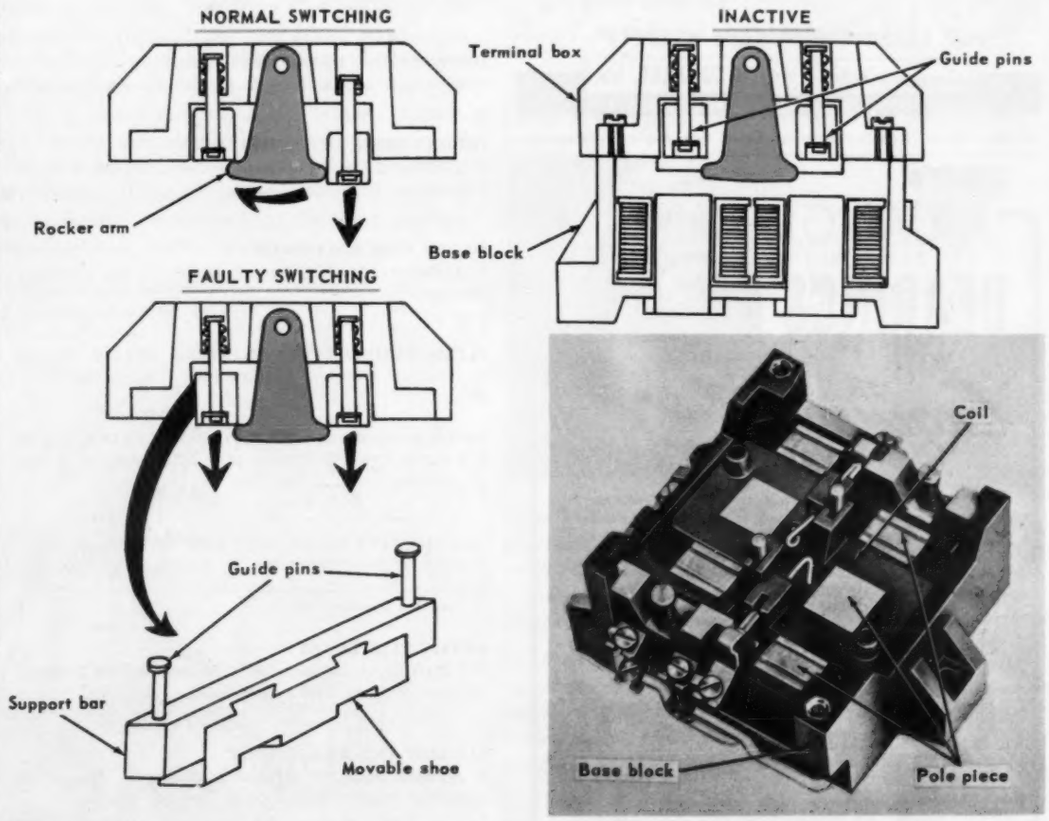
Connection Plates Double as Fixed Contacts

Celestino O. Lubatti, Italian Editor

The single terminal box of a three-phase motor reverser carries a number of connection plates shaped to work as stationary contacts. This design combines in one unit the two interconnected, but usually separate, contactors of a common reverser and eliminates the need for folded conductors.

The terminal box is screwed to a base block accommodating the stationary magnetic coils and pole pieces. A support bar for each row of contacts holds the movable shoe and the contact beams. The two support bars are pin-guided in the head walls of the terminal box. When one coil is energized, the corresponding pole piece draws one row of contact beams against the stationary plates. Because of their shape and staggered position, the plates form alternate connections providing motor rotation in either direction.

A mechanical lock utilizing two rocker arms with side detents prevents simultaneous operation of both rows of contacts. Detents alternately engage one of the support bars to prevent its operation and leave the other free for magnetic attraction. The reverser unit is a development of Costruzioni Electriche C. Grand, Turin, Italy.



SUPPORT BARS carry movable shoes and spring-loaded contact beams. Electromagnets in base block are staggered to match shoes. Mechanical lock includes two rocker arms which freely hang on their pivots. When one support bar is attracted (normal switching), rocker arm swings to stop inactive bar with one of its detents. If faulty switching causes attraction of both bars, rocker-arm detents remain engaged with bars to keep reverser inactive.

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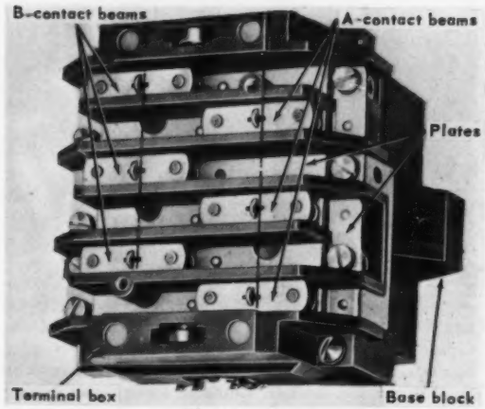
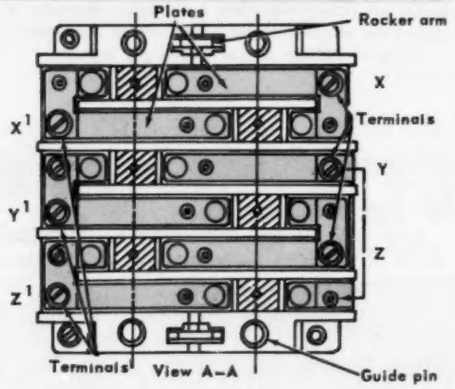
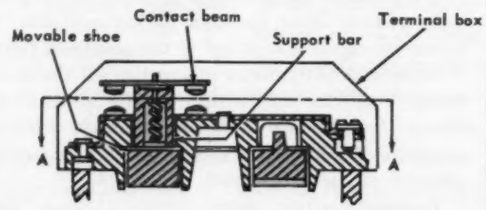
to Simplify Reverser





	Connected Terminals		
A-contacts dropped	$X-X^1$	Y^1-Z	Z^1-Y
B-contacts dropped	$X-X^1$	$Y-Y^1$	$Z-Z^1$



TWO CONTACT BEAM SETS are dropped individually by electromagnets (not visible) to change connections between side terminals to reverse turning direction of motor. Standard 15-amp unit measures 100 by 92 by 80 mm (3.9 by 3.6 by 3.1 inch) compared to 235 by 120 by 107 mm (9.2 by 4.7 by 4.2 inch) of conventional equally-rated reverser.

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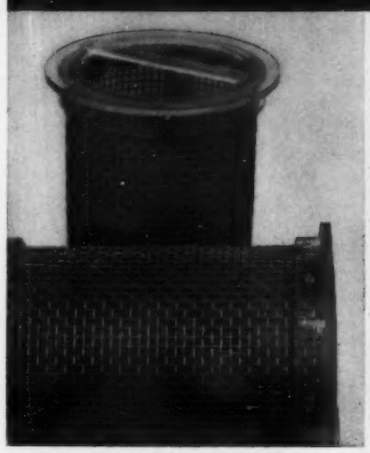
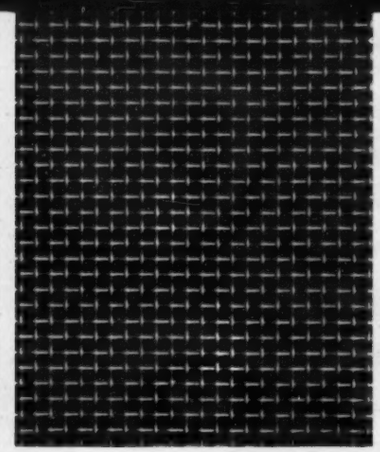
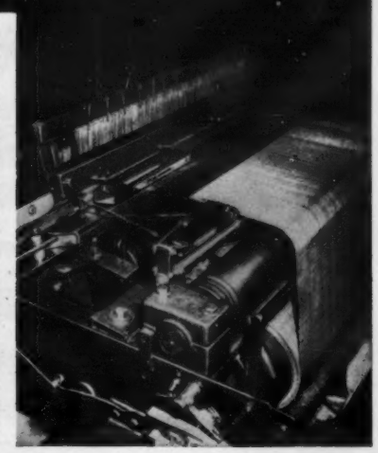


HASTELLOY C*



SILVER



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Refer to our technical data sheets in CHEMICAL ENGINEERING CATALOG, Page 185

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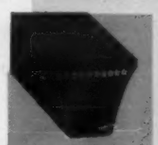
- Handles up to 3 times more hp than conventional V-belts in same space.
- Saves up to 50% in drive space.
- Reduces drive weight 20% and more.
- Cuts drive costs as much as 20%.
- Reduces bearing load, increasing bearing life.
- Guards can be smaller, lighter weight.
- Belt speed up to 6000 ft/min possible without dynamic balancing.
- Less costly, higher speed motors can often be used.



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Gates

Building the future on 50 years of progress

Gates Super HC V-Belt Drives

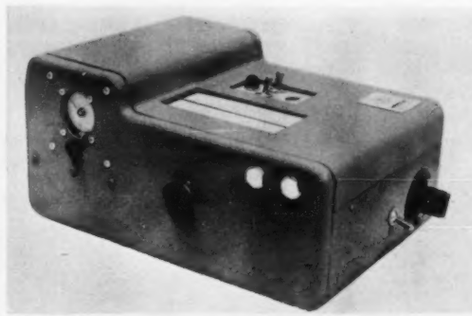
Circle 31 on Reader-Service Card for more information

IDEAS . . .

ELECTRICAL DEVICES

Helix Is Stylus

Edward W. Schrader, Western Editor



RECORDER has low chart rate of 12 inches per hour. Paper is heavily scored at one-minute intervals with lighter scoring at 1/5th-minute intervals. Fifteen-minute intervals are also marked. Amplified input signal driving stylus has closed loop servo for stability. Recorder is designed for charting inputs of unlimited amplitudes and occuring at rates as low as 1 cycle per minute.

The stylus in a chart recorder is a single-turn-ridged helix. The helix on the stylus drum gives a point contact to the paper. As the helix rotates, the point contact moves across the paper.

One turn of the helix gives full-scale movement of the stylus across the chart. Continuous rotation of the helix causes the stylus to retrace the chart in the same direction. Recordings that normally would be off-scale with a conventional pin drive are preserved. At the completion of one turn, the stylus reaches the extremity of the paper. The point of discontinuity shows this, and the trace appears on the starting side of the paper immediately opposite the discontinuity.

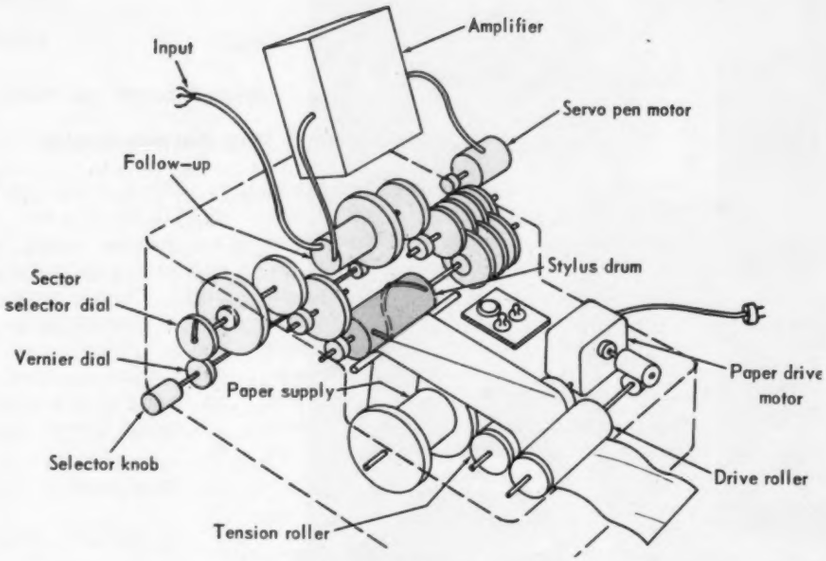
The recorder accepts a voltage input signal which is amplified to drive a servo motor. A gear train reduces drive speed of the stylus drum. A follow-up signal is supplied to the amplifier from a rotating potentiometer or synchro off the gear train. A selector dial with a vernier adjustment selects the reference point on the chart. This is accomplished by means of a gear train engaging one end of the stylus drum.

Pressure-sensitive paper moves through the recorder by means of a friction drive between two soft rubber-rollers powered by synchronous motor.

The chart recorder is a product of Metrolog Corp., A Subsidiary of Air Logistics Corp., Pasadena, Calif.

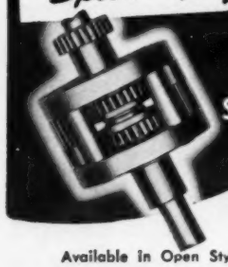
in Chart Recorder

SINGLE HELIX on stylus drum makes point contact with pressure-sensitive paper. Spring-loaded platen pushes paper against helix to create trace. Plastic window in hinged cover protects pressure-sensitive chart paper.



Solve Control Problems of *Speed – Torque – Instruments*

WITH **Milwaukee** SMALL DIFFERENTIALS



Available in Open Style (as illustrated) or in Enclosed Style.

Design Engineers! Use these small, precision made, mechanical differentials where measuring or controlling of speeds is involved. They are adaptable to many other applications, such as: Control of Torque, Speed Changing, Remote Controls, Broad Range Step Transmission, Position Controllers or Follow-up System, Clutches, Sequence Controllers.

Further detailed information available upon request.

MILWAUKEE LOCK & MFG. CO.
5084 N. 37TH STREET • MILWAUKEE 9, WISCONSIN

Circle 32 on Reader-Service Card for more information

NEW! Waterproof!

NOW STANDARD ON ALL REGULARLY CATALOGUED JE SOLENOID VALVES

New epoxy-clad coils are line-tested at 2300 volts completely submerged in water. Eliminate coil failure! Impervious to almost anything and everything—condensation, fluid spray, frost, oil, gasoline and other corrosive liquids and vapors. Unlimited indoor or outdoor applications. U.L. listed. Wire, write, or phone:

CONTROLS DIVISION **JACKES EVANS MFG. CO.**
4427 GERALDINE AVENUE • ST. LOUIS 15, MO.

Circle 33 on Reader-Service Card for more information

VERS-O-LINE
bearings by Hartford

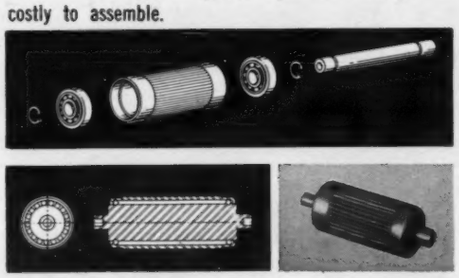
PRE-VALUE ANALYZED *for your product*

Hartford's Vers-O-Line is constantly expanding to meet the demand of value analysts for one economical unit to replace several more costly integral parts. Instead of specifying more costly precision bearings explore the possibilities of Vers-O-Line. Hartford engineers can help your design engineers by recommending or adapting a bearing from a wide variety available in stock or can imagineer a new design to meet your product specification that can be produced to effect substantial savings. Types of Hartford bearings in Vers-O-Line include:

RADIAL . . *H-Series*
RADIAL . . *Conrad Loaded*
RADIAL . . *Full Complement*
THRUST
VERSA-TWIN . . *Twin Row*

TYPICAL EXAMPLE

Before—Six separate parts, expensive bearings and costly to assemble.



After—One complete economical assembly, reduced parts, maximum stability.

Write for comprehensive technical literature containing case history applications and helpful bearing ideas.

Specify Hartford PRECISION BALLS • BEARINGS

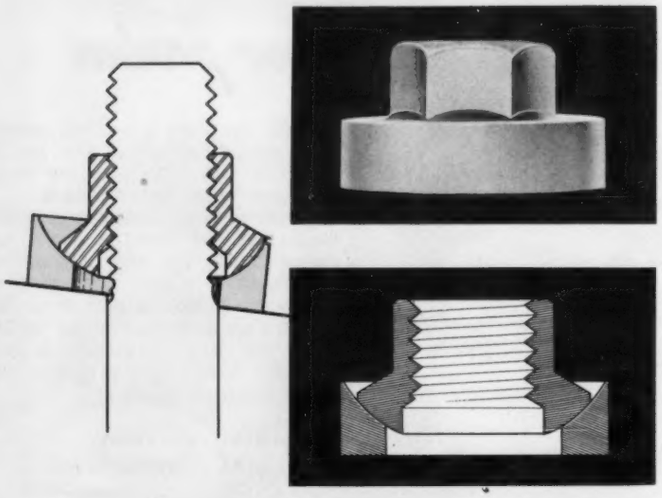
HARTFORD STEEL BALL COMPANY, INC., 34 Jefferson Ave., West Hartford, Conn.

Circle 34 on Reader-Service Card for more information

NEW PRODUCTS

For more information on products described, circle on the Reader-Service Card the numbers appearing opposite the story headlines and drop the card in the mail.

MECHANICAL



Self-Aligning Fastener 301

Seats along 8 Deg Perpendicular

A self-aligning locknut develops full rate of strength of aircraft bolts even though seating surface is as much as 8 deg out of perpendicular to shank. Compensating fastener consists of a hex drive featherweight series self-locking nut which swivels within spherical seat of a precision alignment washer. The unit maintains constant bearing area between alignment washer and nut from 0 to 8 deg. Full rated strength of 160,000 psi (ultimate tensile of nut) can be utilized at all angles. Both components of SA16 are alloy steel, operational to 550F. Nut locking torque meets MIL-N-25027, and wrenching meets NAS 1291 and MS 21042. SPS units are made in diameter sizes No. 10 through 5/8 inch, in Class 3B NC and NF thread series. They are supplied either cadmium plated or with addition of an improved dry film lubricant.

Standard Pressed Steel Co., Jenkintown, Pa.

Brake-Clutch 302

Engage, Disengage in 12 Milliseconds

Electrically-operated brake-clutch components in sizes 8 and 11 have standard BuOrd mountings and are designed for use in motor-potentiometer, motor-gearhead or other control assembly configurations requiring fast stopping or starting. Size 11 weighs less than 5 oz and is 1.839 inches in length, exclusive of shafts. Input and output shafts are coaxial and may be supplied with extensions from either or both ends of component. Minimum brake or clutch torque is 16 oz-in, and total response time from brake-disengage to clutch-engage is 23 milliseconds. The device is designed for 28v d-c operation, and actuating coil is impregnated and potted into housing. Size 8 is 1.530 inches and weighs 2.5 oz. Torque for braking or clutching is 8 oz-in minimum. Both sizes may be supplied as brakes only or as clutches only. Both units conform to applicable requirements of MIL-E-5272.

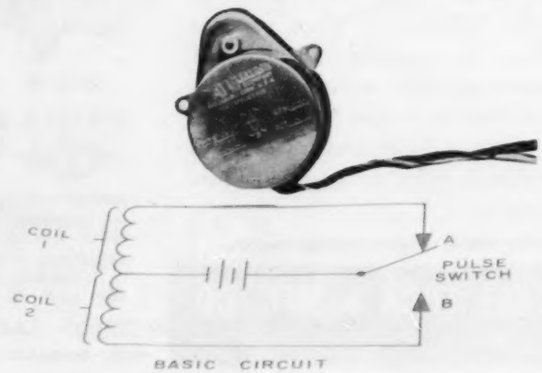
Bowmar Instrument Corp., 8000 Bluffton Rd., Fort Wayne, Ind.

Small Stepper Motor 303

Eliminates Mechanical Ratchets

A thin ultra-quiet stepper motor, operating on low voltage and eliminating mechanical ratchets, features low radiated magnetic field and high accuracy. The series 18100 does not require mechanical one-way devices, electrical contacts or a commutator. It may be operated with windings continuously energized in static condition or pulsed at rates up to 2400 steps per minute. Since windings have a low L/R ratio, stepper is suited to high-speed stepping applications where pulse power is limited. Capable of withstanding 100 G shock for 7 ms, as well as acceleration of 10 G, the device meets requirements of Procedures I though VII of MIL-E-5272C and is operable from 85 to —54C. Pulse requirements are 12.5 ms minimum—delivering 80 pulses per second. Rated at 27v d-c, the rotary component has a continuous-duty cycle and rotor step angle of 30 deg per cycle.

A. W. Haydon Co., Waterbury, Conn.



Synchronous Motor 304

Eliminates Non-Start on Dead Center

A high-torque, permanent-magnet, synchronous motor, for electromechanical devices, uses an L-shaped variable-pole arm, eliminating possibility of non-start when motor is on dead center. If poles of rotor should stop on dead center, magnetism induced in variable-pole arm by field coil will start rotor. Standard motor speeds range from 10 to 1/60 rpm. A positive-drive clutch can be provided which is incorporated in internal gear reduction section on most models. Permanent-magnet types are obtainable in clockwise or counterclockwise rotation, 115v, 60-cycles standard. Standard motor is rated at 20 oz-in at 1 rpm and high-torque model is rated at 40 oz-in at 1 rpm.

Lake City, Inc., Crystal Lake, Ill.

Internal Wrenching Fasteners 305

Withstand 130,000 PSI

High temperatures up to 1800F are applications for this line of internal wrenching bolts. Bolts are stocked in popular thread sizes and lengths made in high-temperature material AMS 5735 with tensile strengths of 130,000 psi minimum. Heads are designed to accept standard Allen-type wrenches. Fasteners can also be supplied in materials such as 19-9DL, Inconel X, M-252, titanium and other heat-resistant space-age alloys. Special sizes and types can normally be supplied in 10-14 days. Application engineering assistance and detailed drawings are obtainable.

Mercury Air Parts Co., Inc., 9310 W. Jefferson Blvd., Culver City, Calif.

NAME YOUR STAINLESS SHAPE!

The design and manufacture of quality stainless steel castings is a specialized job . . . *and Dodge specializes in it!*

There is practically no limit to the variety of shapes we can turn out to meet your simple or intricate specifications precisely . . . economically.

Perhaps one or more DS castings shown here will help spark an idea of how Dodge can be of assistance for *your* stainless steel casting needs. A blueprint or sketch with operational details will bring complete information, without obligation.

DODGE STEEL COMPANY

6501 State Road

Philadelphia 35, Pa.

• *Phone: DEvonshire 2-2200*

DS DODGE PRODUCTS

THE MOST IMPORTANT ALLOY IN A STAINLESS STEEL CASTING IS QUALITY

Circle 36 on Reader-Service Card for more information

Precision Mechanical Differential 306

A miniature differential handles loads up to 75 oz-in and speeds to 3500 rpm. It is suited for use in servo systems and for integrating mathematical functions in computing equipment. Employing precision bevel gearing, backlash is held to 1½ minutes with 0.5 oz-in checking load, and starting torque kept to a relatively low value of 0.1 oz-in. Various operating configurations are made possible as a result of differential's hollow shaft construction. All parts are stainless steel. Materials and finishes may

be varied to conform to applicable military specifications. The X-1943 can be supplied in a range of end gear ratios to satisfy various operating requirements.

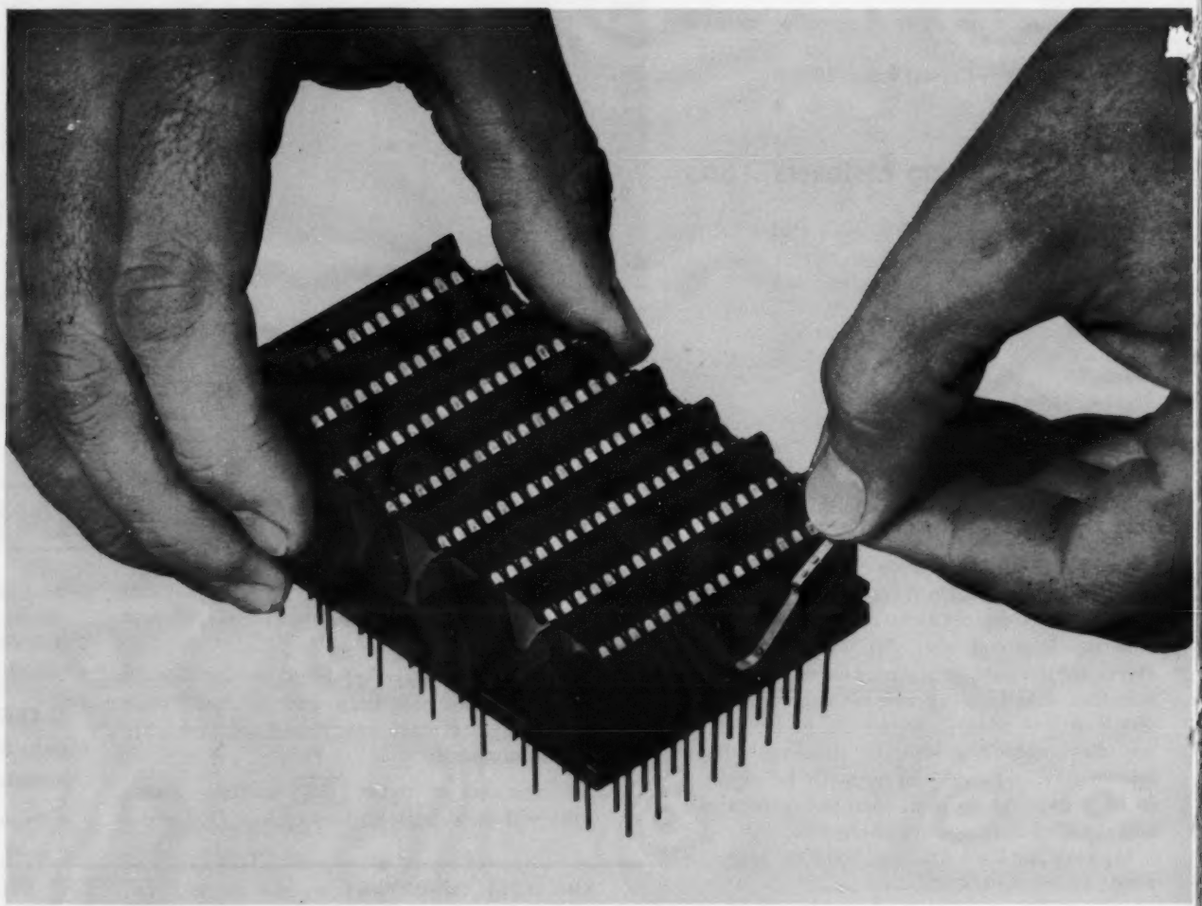
Bowmar Instrument Corp., 8000 Bluffton Rd., Fort Wayne, Ind.

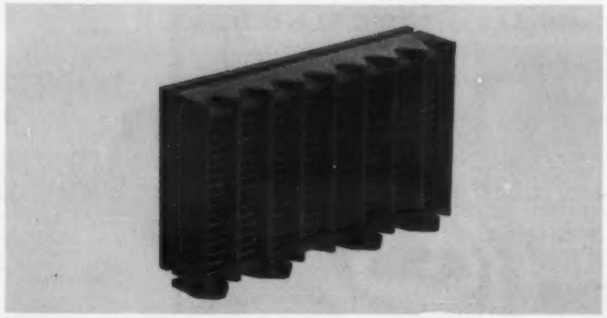
SYLVANIA PRODUCES & DELIVERS THE COMPLETED ASSEMBLY

—at substantial savings to IBM

This electrical connector block is a vital link in the electrical system of an IBM computer. Unless it is built to exact tolerances, the computer can malfunction.

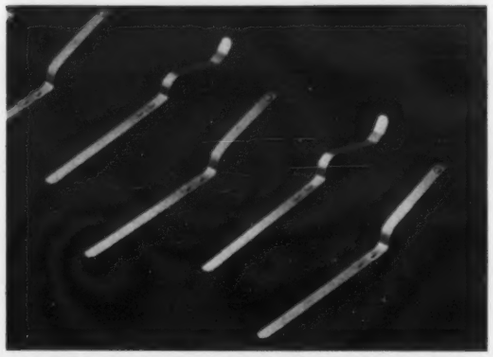
To make this critical part, IBM chose Sylvania because we could perform the entire production sequence—from raw materials to completed assemblies built to tolerances in terms of thousandths of an inch. It soon proved the Sylvania experience paid off in two ways: in production economies and in fast delivery too. Total result: a better connector block—at lower cost. (For details see captions to pictures on these pages.) For full information on how Sylvania custom facilities can benefit *you*, or for a quote on a specific project, write Sylvania Electric Products Inc., Parts Division, Warren, Penn.





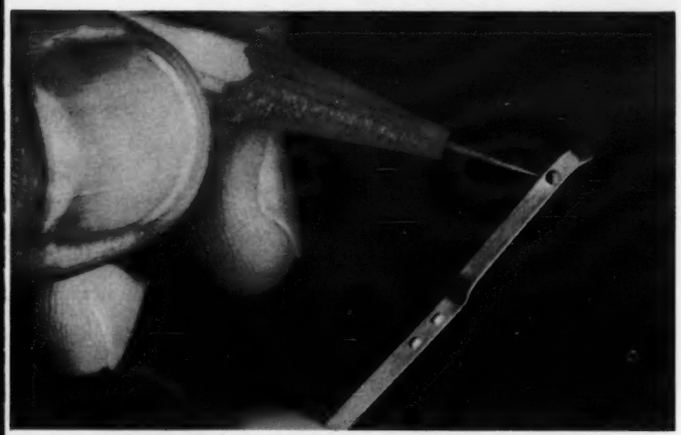
MOLDED FROM PLASTIC by Sylvania, the IBM connector block meets tightest specifications. This is possible because Sylvania maintains one of the world's most modern and complete lines of automatic molding equipment. This equipment permits Sylvania to handle volume orders for compression, injection and transfer molding. And a unique bank of rotary presses can produce millions of precision parts each day—even using phenolics and urea.

Result to IBM? Precisely formed parts to fill high-volume requirements.

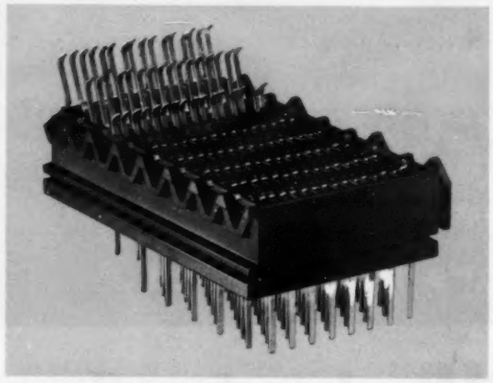


MADE FROM SYLVANIA WIRE, precision-rolled ribbon connectors offer high reliability when the circuitry is completed using wire wrap contact methods. The cross section of the ribbon—.023″ x .062″—and the corner radius of .003″ were accomplished on a special three-head tandem rolling mill and special forming equipment.

Result of this flexibility to IBM? Top reliability at close tolerances.



CUSTOM METAL STAMPING AND DOT WELDING, in one operation, also paid big dividends to IBM. The original plans called for forming parts and then gold-plating the entire contact. Following a request by IBM to extend contact life and reduce costs, Sylvania experience paid off. Sylvania Engineers demonstrated they could weld a tiny gold dot at the contact point economically while maintaining close tolerance on the critical dimensions of the formed contact. High-speed, high-volume techniques enable Sylvania to meet critical deflection and sheer tests. Sylvania maintains a metal stamping facility which includes multi-slide machines, vertical presses, and specially developed machines to help solve your special problems.



CUSTOM ASSEMBLY by Sylvania of the block and the parade of contacts is handled by our corps of trained specialists. Many of our customers have found that Sylvania can often deliver completely assembled and packaged products—using either all Sylvania components or all customer components, or both—*at lower cost than is possible in the customer's own facilities.*

Result to IBM? Many, many thousands of completed top-quality assemblies per month, and to tolerances specified for automatic wire wrap.

QC SERVICE MEANS QUALITY CONTROL!

At Sylvania, a tough-minded, hard-to-please quality control department has full authority for assuring the parts Sylvania produces meet your most stringent specifications. Example of this thoroughness: for the IBM connector block, Sylvania used *100% inspection!*

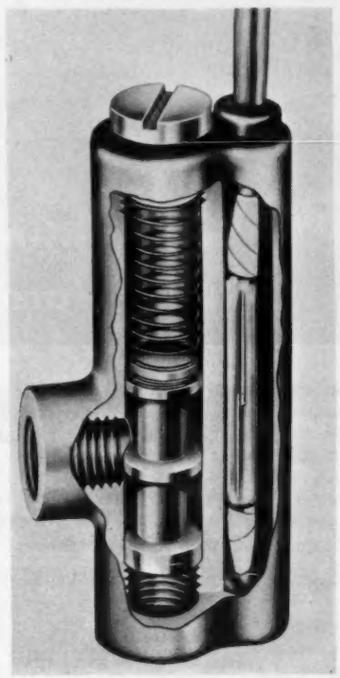
SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

Circle 37 on Reader-Service Card for more information

Low-Cost Flow Switch 307

A low-capacity unit that actuates on a pre-set flow rate provides a dependable device for detecting flow or lack of flow in small piping and tubing systems. The unit may operate a remotely located indicator, visual or audio; or through automatic interlock, control pump motors through suitable relays. A pressure differential of less than ½ psi displaces magnet-equipped piston. Permanent



magnet in turn actuates hermetically sealed switch contacts. The device provides good reliability due to all-bronze construction and single moving part. FS-925 can be calibrated for actuation in any position. The ¼-inch NPT ports permit use of standard piping or can be adapted to tubing requirements.

Gems Co., Inc., Sheppard Lane, Farmington, Conn.

A.W. ALGRIP abrasive flooring

Bits of food just naturally fall from barrels and open cartons onto the floor of this freezer at the warehouse of a nationally-known frozen food processor, but A. W. ALGRIP eliminates slipping and sliding . . . helps prevent accidents.

A. W. ALGRIP rolled steel floor plate is produced by Alan Wood Steel Company under a patented process by which an abrasive—just like the kind used in grinding wheels—is embedded to a controlled depth. It becomes an integral part of a tough steel plate.

A. W. ALGRIP can be used as independent flooring . . . or as flooring overlay, on level or inclined surfaces. Put your plant on a safe footing, with A. W. ALGRIP . . . Approved for Safety by Underwriters' Laboratories. Write for Bulletin AL-S3.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada—A. C. Leslie & Co. Ltd.

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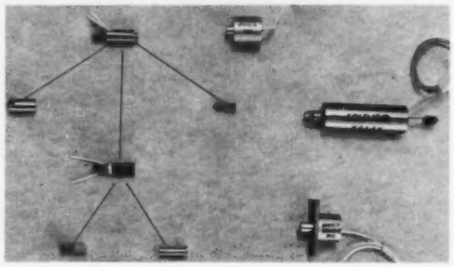
MECHANICAL

Miniature Solenoids 308



Designed to meet requirements of MIL-S-4040C, these solenoids are manufactured with diameters of ¼, 5/16 and ½ inch; voltage ranges of 6, 12, 24, 36, 115 and 230v d-c. Power rating is ¼w and up. Solenoids may be used for applications in digital computers, printers, punched tape, block readers, automatic calculators, code bar switches, high-speed printers, integrated data processing equipment, tape readers, X-Y plotters, digital modules and other electro-mechanical systems.

Cannon Electric Co., 3208 Humboldt St., Los Angeles 31, Calif.

Nylon Gears 309

Precision nylon cut gears with molded metal insert hubs are offered in 48, 32, 24, 20, 16 and 12 pitch and in 14½ and 20-deg pressure angles. "Nymet" line is manufactured with cut tooth gears up to 3 inch OD with a ½-inch face in any quantity without tool charge. Hub is locked radially by means of hex shape and axially by means of channel cut around hexagonal face. This design offers maximum resistance to shock, torsion and vibration. "Hexlok" inserts are of extended hub design and can be provided plain or drilled and tapped with socket-head set screws. Hubs are available in steel, stainless steel, brass and aluminum alloy. Samples available.

Climax Metal Products Co., 863 E. 140th St., Cleveland 10, Ohio.

He's the designer who first put Luster-On® on the job!

Luster-On is The Chemical Corporation's low-cost protective finish for aluminum, brass, cadmium, copper or zinc. It is supplied in a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in a single, simple, economical operation. Available as a liquid or powder for immediate delivery.

Specify Luster-On, Best —

FOR BRILLIANT CORROSION-RESISTANT FINISHES . . . rivals even chrome in many instances where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT AND IRIDESCENT COATINGS . . . imparts striking, attractive appearance with complete corrosion protection, even when humidity and handling are encountered during processing. Also available are yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . . on low-cost zinc. Brilliant golds, yellows, blues, reds, greens, violets, brass and copper hues.

FOR ALUMINUM . . . replaces expensive anodizing where surface hardness is not of prime importance. An excellent finish for paint bonding.

FOR LASTING BRIGHTNESS . . . on both copper and brass without noxious fuming.

FOR DIE-CASTINGS . . . one quick dip provides uniform finish; superb as a base for painting.

See for yourself what Luster-On can do for you! Send us a sample part — now — for free processing. Data sheets on request.

Luster-On — first and still the finest in conversion coatings.

The Chemical Corporation

69 Waltham Avenue • Springfield 9, Mass.

Circle 40 on Reader-Service Card

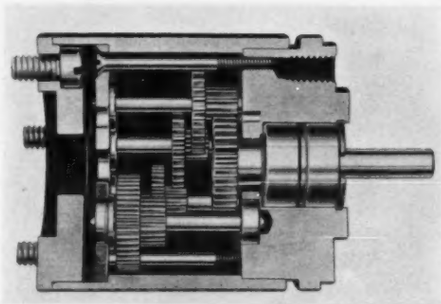
Miniature Lighted Counter 310

Records up to 20 Pulses per Second

Size .....1-5/16 by 2 by 2⅝ inches overall
Current ....counter, 0.300 amp; light, 0.040 amp
Duty cycle .....continuous
Life .....1 million counts minimum
Temperature .....—65F to 160F
Vibration .....MIL-E-5272A-1, Procedure I
Shock .....MIL-E-5272A-1, para. 4.15.2.I
Acceleration .....MIL-E-5272A-1, Procedure II
Humidity MIL-E-5272A-I
Altitude .....over 50,000 ft
Operating voltage .....6, 12, 24 and 110v d-c

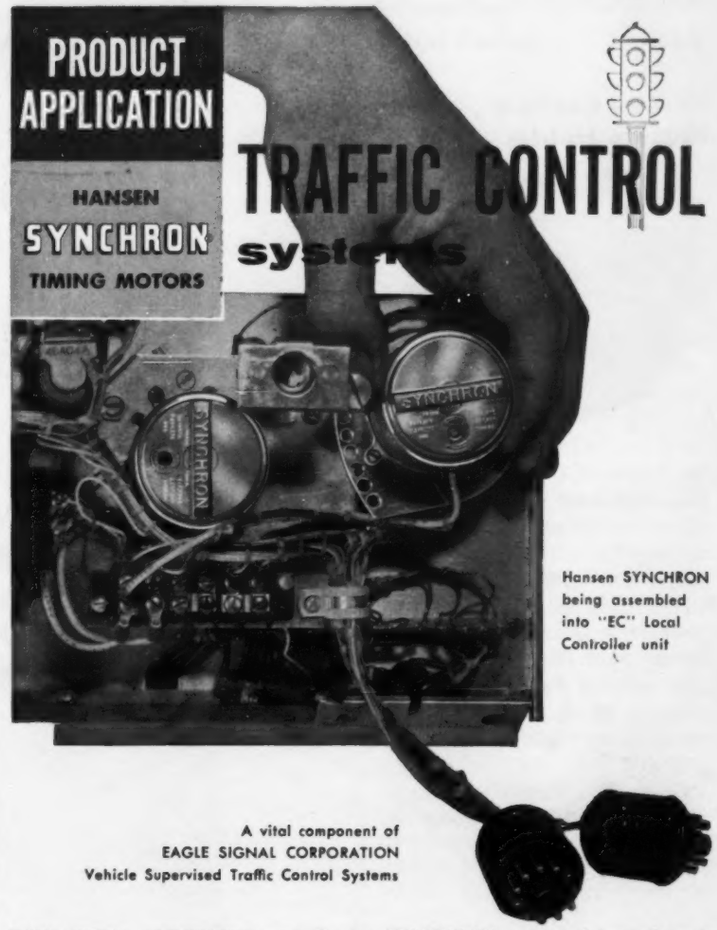
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing 1, Mich.

Speed Reducers, Gearheads 311



BuOrd size 11 frame speed reducers and gearheads, made with postless-type construction, mount on standard BuOrd MK 14 servomotors. Offered in special ratio, physical characteristics and mechanical specifications, units are lubricated with ABEC-7 ball bearings and shielded output bearings. Sleeve bearings are optional. All gears and pinions are hardened and passivated to meet corrosion-resistance requirements. Internal slip clutches may be incorporated upon request.

Planet Instrument, Inc., 616 S. Lafayette St., Ft. Wayne, Ind.



Hansen SYNCHRON being assembled into "EC" Local Controller unit

A vital component of EAGLE SIGNAL CORPORATION Vehicle Supervised Traffic Control Systems

EAGLE SIGNAL CORPORATION uses Hansen SYNCHRON motors for synchronous power to govern signal timing operations in "EC" Traffic Control Systems. Hansen SYNCHRON motors regulate amber and pedestrian clearing intervals — and all other intervals which remain *constant* regardless of cycle length . . . and also govern the 4 independent traffic splits (time division for vehicular traffic) — as well as any interval which is *variable* according to cycle length. The Hansen SYNCHRON, regulating constant intervals, operates on 60-cycle power supply . . . the one governing variable intervals responds to variable frequency from the master control unit.

HANSEN SYNCHRON TIMING MOTORS were chosen by Eagle Signal after careful testing of several makes of synchronous motors. Due to the size of some timing devices and control units, a small motor with good performance characteristics was needed to fit the space limitations. After extensive tests, Hansen SYNCHRON motors were specified for: (1) high-quality performance under test; (2) lower cost; (3) long-life operation as an integral part of traffic control units. Since adoption, Eagle Signal has never experienced an assembly slowdown or stoppage due to failure on service or delivery of Hansen SYNCHRON Timing Motors.

SEND TODAY for informative folder containing specifications and technical data on all Hansen SYNCHRON motors and clock movements.

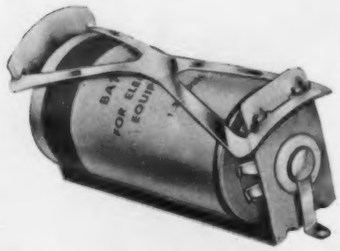
HANSEN MANUFACTURING COMPANY, INC. PRINCETON, INDIANA

HANSEN REPRESENTATIVES:
THE FROMM COMPANY
5150 W. Madison, Chicago, Illinois
H. C. JOHNSON AGENCIES, INC.
Rochester, N. Y. — Buffalo, N. Y. — Syracuse, N. Y.
Binghamton, N. Y. — Schenectady, N. Y.
ELECTRIC MOTOR ENGINEERING, INC.
Los Angeles, Calif. — (OLive 1-3220)
Oakland, California
WINSLOW ELECTRIC CO.
New York, N.Y. — Essex, Conn. (SOuth 7-8229)
Philadelphia, Penn. Cleveland, Ohio

Sweet's Product Design File

Circle 41 on Reader-Service Card for more information

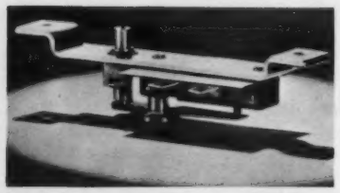
'D' Cell Carbon Battery Holder 312



A spring-loaded end on the 2890 battery holder allows insertion of the size "D" cell in tight spots no longer than holder itself. The device is 3.010 by 1-5/32 inches. A "locking strap" holds battery securely, even under severe shock and vibration. Strap and base are available in gold, nickel or silver. All parts are nonferrous and electroplated.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Snap-Action Thermostat 313



Contacts and contact members of the D series snap-action thermostat are enclosed for protection against dust and corrosion. The exposed quick-response bimetal can operate on differentials as narrow as 5F. Three styles are offered: type D, non-adjustable; type D, adjustable; and tvpe DM, manual reset. The D series can be supplied also for SPDT operation.

Norwalk Thermostat Co., 65 Norwalk, Ohio.

PRODUCT BY ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

PROCESSING BY NSE

PRE-PAINT PROTECTION BY
AMCHEM ALODINE*

A typical Alcoa Alumaluro building siding installation is shown in the clean, functional lines of the Robinson Building, Elyria, Ohio.

How Amchem Pre-Paint Treatment, NSE Processing Help Put the "Lure" in Alcoa Alumalure!**

Alcoa Alumalure baked enamel finish on industrial roofing and siding sheet has made a startling impact in building circles. A low cost, decorative, maintenance-free exterior wall surface, available in 11 colors, it is widely used for new buildings as well as remodeling older structures.

Key to Alumalure success—strong, light aluminum and design innovations by Alcoa . . . precision finishing by NSE Signs & Stampings . . . unmatched protection and paint adhesion by Amchem Alodine chemicals.

With color matching standards a prime-requisite, assurance of paint adhesion on Alumalure sheets is a vital necessity to protect customers who buy the product, months later reorder and expect exact color match. Results to date on millions of square feet of Alumalure processed—no paint failure or rejects involving chemical treatment by Alodine!

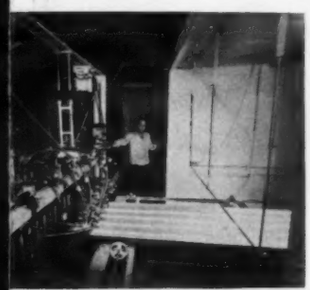
Rigid quality control has resulted in a fine production record for Alumalure at NSE's Birmingham plant.

Full time NSE and Alcoa inspectors watchdog every foot of sheet throughout the production cycle. For chemical pre-treatment Alcoa specifies high standards of Government Specification MIL-C-5541. NSE selected and uses Alodine for "the best metal preparation treatment you can find." NSE management states emphatically, "There's no question about what Alodine has done for the preparation of aluminum for painting. We don't have paint failures. We don't have customer rejects."

An "extra" plus from Alodine—Alcoa finds additional customer appeal in the gold coat Alodine creates on Alumalure backing which provides a pleasing antique decorative finish for building interiors.

If you want—corrosion resistance, lasting paint adhesion, rejects slashed to the vanishing point and sales ammunition that helps sell products—investigate Alodine, the industry's first and today's standard conversion coating chemical for aluminum!

* Amchem's trademark for its conversion chemical coating for aluminum.
** Trademark of Aluminum Company of America.

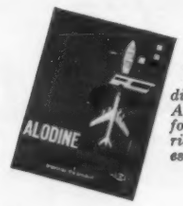


After treatment with Alodine, a ribbed siding sheet is painted employing Ransburg electrostatic paint equipment. NSE can run two sheets in tandem, accomplishing 60-lineal feet per minute painting.

NSE Executive Vice-President John Montgomery (left), Plant Manager R. Cater Lee, and Alcoa (quality standards) specialist J. Shea (right), inspect "3D" Alumalure sheet.

The massive equipment shown here is an ultra-modern, newly installed Lanly oven for handling Alumalure sheets.

AMCHEM **ALODINE**



Write for free bulletin 1424C, outlining the uses and many different types of Alodine available for aluminum fabricators and processors.

Amchem is a registered trademark of
AMCHEM PRODUCTS, INC. (Formerly American Chemical Paint Co.)
AMBLER, PA. • Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont.

Circle 42 on Reader-Service Card for more information

Vibrating Reed Relay 314

Using tone modulated RF or single wire conductor, 10 separate switching functions can be remotely controlled with this tiny 1-oz vibrating relay. Each reel controls one function through a tiny secondary relay and resistance-capacitance filter. High "Q" (reed bandwidth selectivity) makes this switching method practically interference-free. Reed units are available in 30 to 3,000-ohm coil resistances, and in impedances from 30 to 5,000 ohms. Driving voltages vary from 1½ to 15v a-c, depending on impedance. Reed contacts will pass up to 5 milliamps. Reed frequencies to within ±5 percent are available. Two, four, six and eight-reed units are also available.

W. S. Deans Co., 8512 Gardendale St., Downey, Calif.

Miniature ½W Potentiometer 315

Printed-circuit boards, encapsulation networks and installations where size and weight are at a premium are design applications of the model D potentiometer. The combination of resistance element and high-quality molded carbon brush provides consistently low noise, a rotational life of 100,000 cycles and an ability to sustain heat overloads of 500F without damage. Resistance values range between 100 ohms and 5 megohms. The unit has a power rating of ½w, a voltage rating of 350v (rms) and an ambient temperature range of from —55 to 120C.

Reon Resistor Corp., Yonkers, N. Y.

Revere helps "fit the metal to the job"

AND A COMMUTATOR MANUFACTURER SAVES ON BOTH MATERIAL COSTS AND OVERALL COSTS WHILE PRODUCING A SUPERIOR PRODUCT

The hub of the small commutator you see above originally was made of a ferrous metal. Certain problems cropped up due to the fact that the rod from which the hubs were fabricated, not only had to be drilled, but it also had to be able to withstand a flanging operation. The engineering department of Dayton Precision Manufacturing Company called in one of Revere's Technical Advisors for consultation.

After a thorough study of the problem Revere Brass Rod of a certain alloy was recommended and samples were furnished. The machinability of the rod was found to be outstanding, being readily and speedily drilled. Also it withstood the flanging operation . . . a set of manufacturing conditions where only brass, the right kind of brass, outshines all other metals and alloys.

Final score: The low first cost of the brass rod, plus its superior machinability, resulted in a more satisfactory product without the penalty of higher costs. A further advantage to the manufacturer was the added sales appeal of the brass hub.

And there you have another example of how Revere in collaboration with the manufacturer helped, "fit the metal to the job," which resulted in a better part at the least possible cost. Why don't you take advantage of this kind of service?

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Ave., New York 17, N. Y.

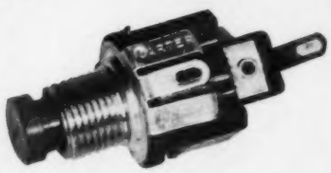
Sales Offices in Principal Cities. Mills: Rome, N. Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb.
Distributors Everywhere.

Neon Indicator 316

The L15100 neon indicator light with built-in 62,000-ohm resistor provides extra reliability in military and aviation applications. This unit features front or rear panel mounting and three lens colors, and employs MS25252 NE2C lamp. The panel light is rated at 0.001 amp at 115v a-c and weighs only 0.020 lb.

Control Switch Div., Controls Co. of America, Folcroft, Pa.

Low-Power Switch 317



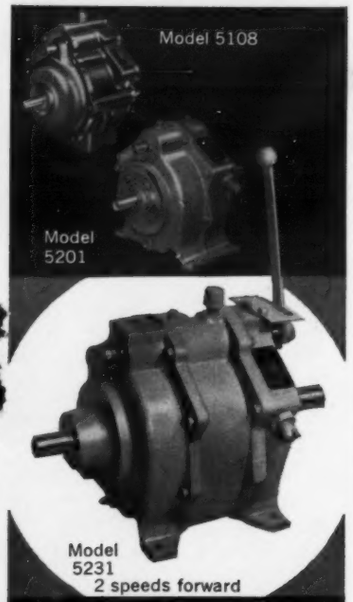
Installations not exceeding 50w are design applications of the S6 series molded pushbutton switch. Three separate contact arrangements are available. Black or red push buttons are standard. (Other colors available on special order.) The miniature device is conservatively rated for ¼ amp at 115v a-c resistive; 2 amps at 30v d-c resistive.

Carter Parts Co., 3041 Madison St., Skokie, Ill.

Circle 43 on Reader-Service Card

S-N REVERSING TRANSMISSIONS

5 models 8 and 28 h.p. with power packed versatility



S-N Reversing Transmissions are performance proven, space-saving single units which reverse under full load. Adaptable to the design or redesign of a wide variety of industrial equipment. For technical data write The Snow-Nabstedt Gear Corp., Hamden, Conn.

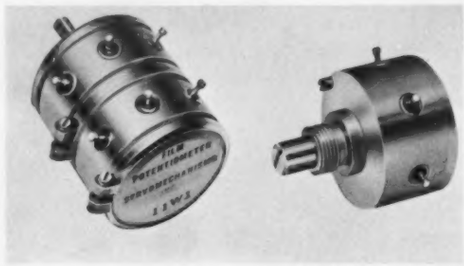
SPECIFICATIONS

Model No.		5231	5201	5108
Reduction Forward		1.97:1 3.34:1	3.16:1	3.75:1
Ratio Reverse		3.37:1	3.16:1	3.75:1
Power Up To		28 HP	28 HP	8 HP
Max. Input Torque in. lbs.		1000	1000	320
Max. Input Speed RPM		2400	2400	2400
Dimensions	Long	15 11/16"	11½"	9 1/16"
	Wide	14"	13½"	10"
	High	14¾"	14¼"	10⅝"

SNOW-NABSTEDT
Industrial Division
Transmission Engineers
For Over Half a Century

Circle 44 on Reader-Service Card

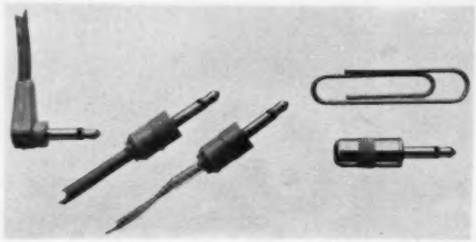
Deposited Film Potentiometers 318



Where small increments of shaft rotation must produce proportionally small changes in resistance, deposited film precision potentiometers suit the application and provide resolution of better than 0.01 percent. This unit exhibits long wear and high rotational life under conditions of high ambient temperature and severe vibration and shock. Potentiometers shown in photograph, which measure only 1-1/16 inches dia, are designed to comply with rigorous environmental specifications for airborne and space equipment. They are available in single or ganged types with shaft housing features adaptable for servo or panel-mounted applications.

Mechatrol, Div. of Servomechanisms, Inc., 1200 Prospect Ave., Westbury, L. I., N. Y.

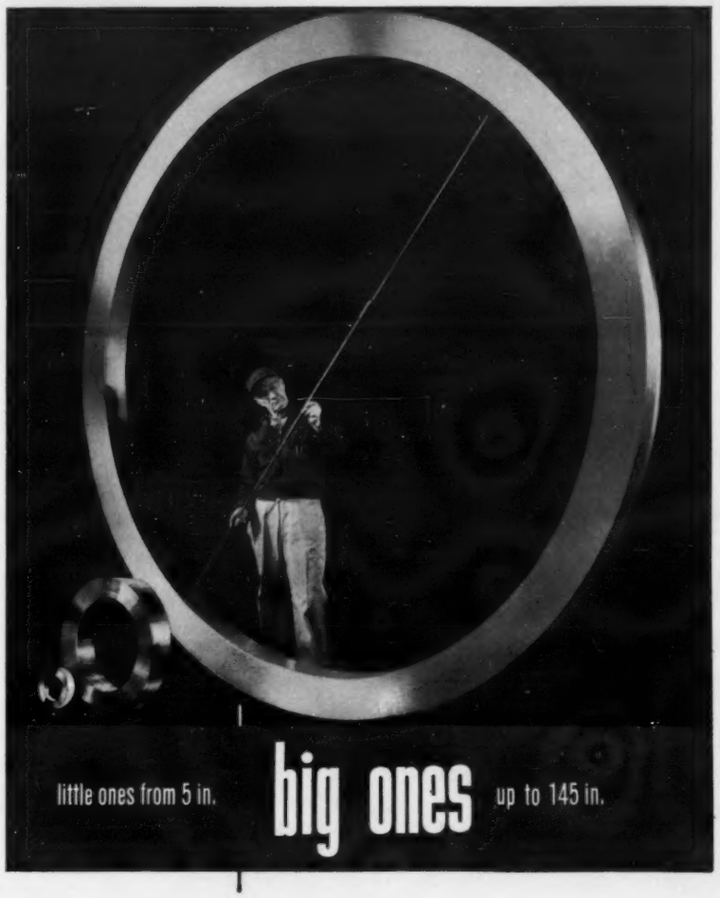
Miniaturized Phone Connector 319



"Micro-Plug", 1/25 the size of a standard phone plug, is useful in such applications as transistor radios, miniature electronic equipment, computing devices and tape recorders. The phone plug is available with straight black (no. 850) and natural (no. 880) anodized aluminum shielded handle. A red shielded handle (no. 855) or a straight molded tenite handle is available molded integrally to phone plug and cable up to 7/64-inch OD (ST-850). Tip and sleeve are machined brass, bright nickel-plated; insulation is molded nylon with tinned brass sleeve terminal.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

How to buy steel rings . . .



consult with experienced maker

Find out about his background . . . experience . . . manufacturing facilities . . . how close he can come to meeting your specifications . . . what engineering assistance he can provide.

put your plans in his hands

When you have found this experienced, reliable supplier, send him your drawings. Give him complete details on materials, shape, tolerances you require, nature of application, and the performance you expect.

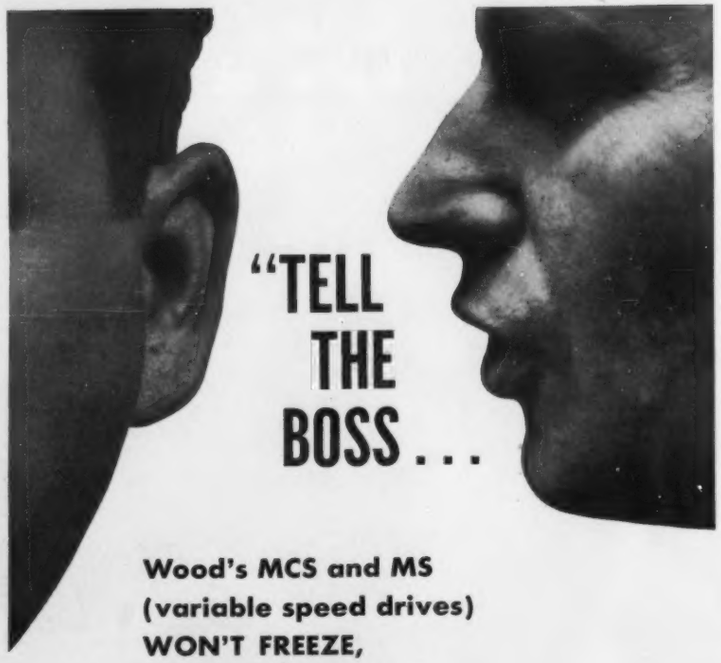
then let him assist you

If Edgewater is your choice, you will find that we will follow your specifications exactly. If required, we can furnish engineering assistance and suggest the material, shape and size to give you the ultimate in performance and economy.

want more details? Write for the Edgewater brochure, which describes our facilities, know-how, and range of sizes and shapes.

Edgewater Steel Company
P.O. Box 478 • Dept. DN • Pittsburgh 30, Pa.

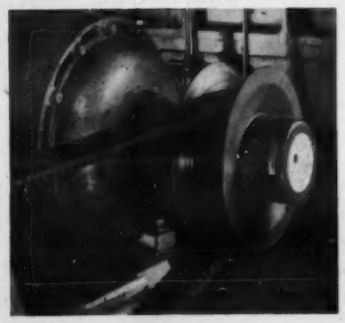
Circle 45 on Reader-Service Card for more information



"TELL THE BOSS . . .

Wood's MCS and MS (variable speed drives) WON'T FREEZE, WON'T STICK"

And, remind him that Wood's MCS and MS motion control drives solve production and maintenance problems no other mechanical variable speed drives can handle. They won't freeze or stick because there are no keys to obstruct lubrication of bearing surfaces. Revolutionary resilient cam followers or pads, located outside the bearing surfaces, permit continuous rotational pumping action, assure even distribution of oil. And, you check lubrication only three or four times a year. Also, Wood's MCS drives hold constant driven speeds under varying torque loads.



Wood's motion control, variable speed drives are available in capacities from fractional to 25 hp. If you and the boss want more information about these remarkable drives, write for BULLETIN 25103.

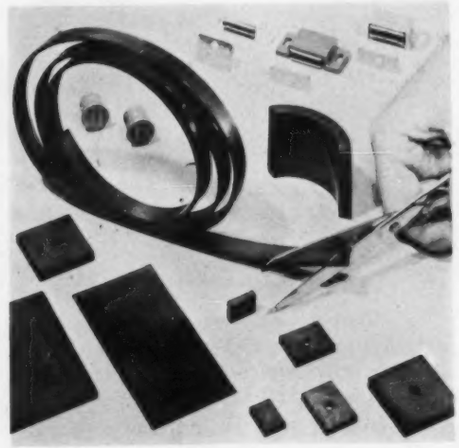
Wood's

T. B. WOOD'S SONS COMPANY • CHAMBERSBURG, PENNSYLVANIA

MCS/2361 ATLANTA · CAMBRIDGE · CHICAGO · CLEVELAND · DALLAS

Circle 46 on Reader-Service Card for more information

Permanent-Magnet Barium Ferrite 320



A low-cost, lightweight, permanent-magnet material which has good magnetic qualities, comparable to sintered isotropic barium ferrite, may be readily cut by ordinary tools. The material is a rubber-bonded barium ferrite, magnetically oriented, with high coercive force and an energy product of approximately one million gauss oersteds. In contrast to sintered magnetic materials, "Plastiform" may be machined or cut. Impact strength is high, and it will not chip in use. Currently, "Plastiform" is used in applications such as magnetic cabinet latches, holding devices, toys and novelties, d-c motors and gasket inserts. The material can be supplied in forms such as rings, sheets and strips.

Leyman Corp., 5178 Crookshank Rd., Cincinnati 38, Ohio.

Silicone Surface Protector 321

Non-porous surfaces such as metal, porcelain, enamel, aluminum, stainless steel, silver, brass, chrome, plastic, formica, micarta, fiberglass and mirrors may be protected with this liquid cleaner. "Tag" leaves no oily film and sets up a hard, waterproof surface. Between applications, a damp cloth removes soil and a dry cloth restores finish. According to manufacturer, "Tag" cuts maintenance time to 50 percent. The liquid protector is available in 14-oz, ½-gal and 1-gal containers. Samples are available.

American Silicone Co., Box A, Englewood, Colo.

VELLUMOID

CHECK...

VELLUMOID

VELLUMOID'S GROWING LIST OF GASKET MATERIALS

... IN TREATED FIBRE
Vellumoid, 444 Fibre, Vellutex, Velcovex

... IN BEATER—ADD
WG-1, WG-5, WG-25, Velbestos 250 (asbestos)

... IN COMPRESSED ASBESTOS
Velbestos 170-1, 170-5, 130-B, 140-B, 170-4B

... IN BUNA-N AND THIOKOL COATED GASKETS AND GASKET MATERIALS
Bucar, Tycar, Coated Vellumoid

... IN OTHER NON-METALLIC MATERIALS

WRITE TODAY!

VELLUMOID

THE VELLUMOID COMPANY
Associated with
DEWEY AND ALMY CHEMICAL DIVISION
W. R. GRACE & CO.
WORCESTER 6, MASSACHUSETTS

Circle 47 on Reader-Service Card

Molding and Bonding Compound 322

Molding, casting, die testing, repairing, modeling, sealing or fastening applications can be done fast and effectively with the "Copy Cast". Easy to apply and shape, material cannot shrink because it contains no solvents. The compound will not crumble when hard, resists acid, alkali, grease, gas, common solvents and weather. Offering high electrical resistance, the material achieves a steel-like finish and can be sawed, chiseled, sanded, filed and painted. A free working sample of the 'desk test' kit is available.

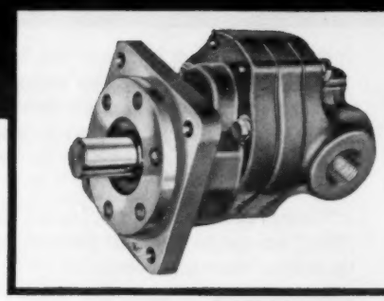
Future Chemicals, 4350 N. Whipple St., Chicago 18, Ill.

Liquid Plastic Sealant 323

The familiar problem of loosening stripper bolts in press tools can be eliminated by the use of a liquid plastic. "Loctite" sealant locks cap and shoulder screws in place, holding them secure against shock and vibration. No softening of screws is required to add locking elements. Parts treated with sealant can be removed with ordinary tools and reused by applying another drop of sealant which will restore full locking action. Ready to use, "Loctite" requires neither heat nor mixing to make it harden. Packaged in plastic squeeze bottles, the liquid locks every size screw and avoids the need to inventory stocks of special mechanical lock fasteners.

American Sealants Co., 705 N. Mountain Rd., Hartford 11, Conn.

Circle 48 on Reader-Service Card



Here's how **WEBSTER** *puts new efficiency in hydraulic power*

We cut this new JE series pump in half to show you why Webster design tops competition in overall efficiency. Specifically, the JE saves horsepower, slashes operating costs, delivers dependable and trouble-free service.

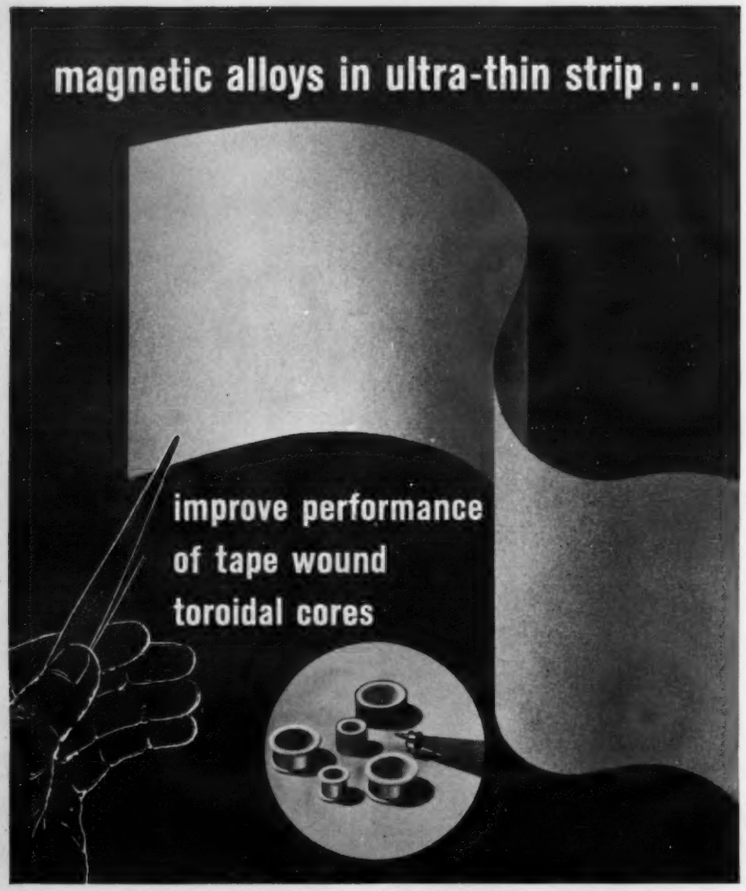
It's the result of this combination of advanced features.... (1) pressure-balanced wear plates for high volumetric efficiency and to prevent clearance changes due to heat; (2) needle bearings for power-saving, anti-friction operation; (3) one piece gear and bearing journal units to assure minimum deflection and proper alignment on both drive and idler assembly; (4) free-floating internal spline drives to eliminate key failures; (5) thrust bearing on drive shaft to absorb compound driving thrusts; (6) double lip seal on drive shaft for added protection against seal failure and dirt.

The Webster JE series pump is a heavy-duty, big power unit built to meet the needs of the mobile industry. It is trim and compact to fit into tight quarters, attaches with a choice of mountings. Your Webster Electric representative has complete specifications and data — or write direct for engineering detailed sheet HY1-1.

JE SERIES PUMPS

Shaft seal: double lip type
Drive: direct, gear or belt
Capacity: 10 sizes — 5 to 40 gpm
Pressures: to 2000 psi
Operating Speeds: to 2400 rpm
Porting: side (std.) end (opt.)
Mounting: SAE Type A (std.)

OIL HYDRAULICS DIVISION
WEBSTER ELECTRIC
RACINE · WIS



Toroids that generate lower heat and higher efficiencies and provide more uniform performance are another advancement made possible by ultra-thin magnetic alloy strip from Precision Metals. This unique material—now available in production quantities—can be supplied in virtually any of the high magnetic permeability alloys such as 4-79 Moly Permalloy, 50-50 grain-oriented nickel iron and Muvar®.

Precision Metals strip and foil is cold rolled in thicknesses from .010" to .0001" and can be furnished slit to tightest dimensional tolerances. Note these other important advantages:

uniform magnetic properties **extremely close tolerances**
dimensional uniformity **excellent surface characteristics**

To meet specific requirements, Precision Metals can furnish custom alloys to your specification in the form you need. Write today for fully illustrated facilities booklet ND-1.

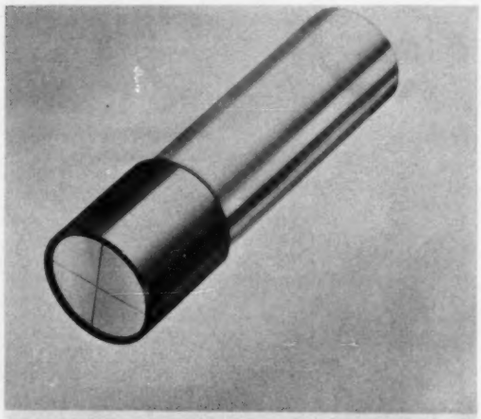
HAMILTON
WATCH COMPANY / **Precision Metals Division**
Lancaster, Pennsylvania

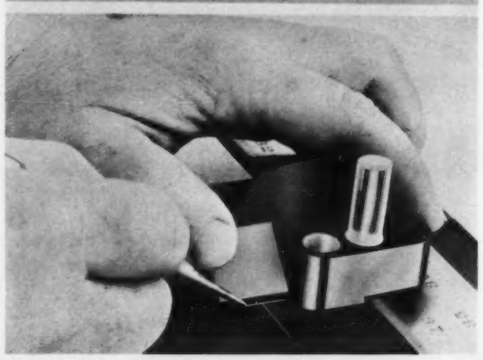
Regional Representatives
COREY STEEL COMPANY • Chicago, Illinois
FAGERSTA STEELS PACIFIC, INC. • Los Angeles, California

Circle 49 on Reader-Service Card for more information

Precision Tooling Instruments 324

Centering and layout instruments provide precision tooling in the metal working industry. The center scope (top photo) is close-tolerance manufactured of optical plastic and is accurate to 0.001 inch with 6.0 power magnification. It is used as a center finder for drilling precision holes, inspection and other tooling applications. When combined with the Scribe Rite (lower photo), instruments provide time-saving benefits





and a high degree of accuracy in layout. Accurate to 0.0005 inch, the combination of both instruments provides exacting template work, precise layout of lines, lofting to determine exact size and shape, layout of large drill plates and fixtures, extension or transfer of scribed lines, or re-establishment of reference lines.

Tool Components, Inc., 12923 Budlong Ave., Gardena, Calif.

SINCE 1917

We've been meeting the need for precision manufacturing facilities

. . . and, we can do it for you, too.

Boehme practical experience in the design and manufacture of mechanical, electrical and electronic products for automation and instrumentation can solve your most exacting demands. Learn more about Boehme's prompt, efficient, economical service and how readily it applies to your needs.

H. O. Boehme, Inc.
Designers and Manufacturers
Communication Equipment
Precision Electro-Mechanical
Apparatus Since 1917
915 Broadway
New York 10, N.Y.

HOB

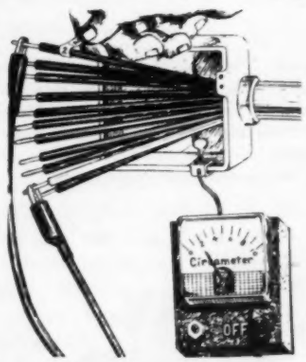
Circle 50 on Reader-Service Card

All-Purpose Cutter 325

An implement for home, office, school and store is a combination scissors and knife for cutting paper, textiles, thin cardboard, string and similar materials. "Snippy" is small, light and designed for safe handling. It cuts along straight or curved lines and is constructed of durable plastic molded into one piece.

Alvin & Co., Inc., 611 Palisado Ave., Windsor, Conn.

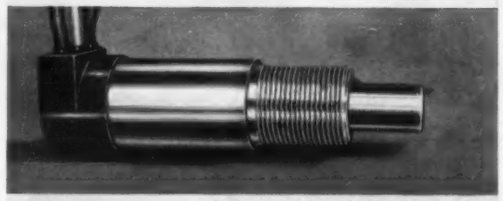
Wire Tracer 326



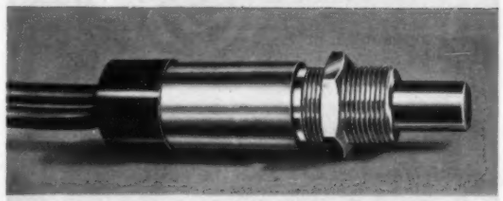
Identification of wires in conduit raceways and continuity testing are applications of the "Circameter". This method enables one man to identify wires, eliminating errors and facilitating testing of wires to meet building codes and blue-print specifications in the field, production or maintenance. The device can also be used in continuity testing ohms scale 0 to 100,000 and in research and development projects where continuous testing of wires, cables and harnesses is required.

Products for Industry, 220 S. Rose St., Los Angeles 54, Calif.

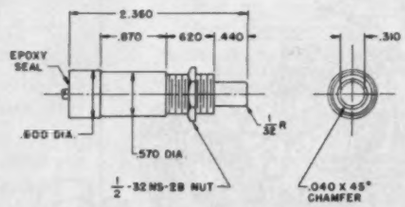
Circle 51 on Reader-Service Card



Model No. W20050



Model No. W20064



RATINGS/ Model No. W20064

Volts.....30 D.C.
Amperes....15 Res.
Weight.....13 lbs. Approx.
Operating Pressure 2½-5 lbs.
Total Actuating Pressure 11 lbs. + 2 lbs.
Pretravel .120 max.

RATINGS/Model No. W20050

Volts 12.8 D.C.
Amperes { n.o. 10 Ind. / n.c. 1 Ind.
Weight .14 lb. Approx.
Operating Pressure 2½-5 lbs.
Total Actuating Pressure 11 lbs. + 2 lbs.
Pretravel .120 max.

A Switch in Luxury Driving...

Lincoln Continental for 1961 has introduced a new concept of motoring luxury to feature unparalleled quality. Every component—regardless of function—must be of first quality and must undergo rigid testing before assembly in the car. A special electronic console, for example, tests all electrical parts—including CONTROL SWITCH products—not only for flaws but also to make sure that each component draws just the right amount of current.

Actually, the CONTROL SWITCH products—four limit switches with pushbutton actuators—far exceed requirements. In Lincoln Continental's unique four-door convertible, the switches automatically open the rear windows slightly as soon as the handle is moved to open the door. As the door is closed, the window closes. This action, which made possible a new freedom in the rear door design, must be fast and absolutely reliable every time.

To be sure that it is, Lincoln Continental engineers wanted switches which had already been proven in service far more demanding than that to be encountered in the car. Their choice, CONTROL SWITCH DIVISION models W20050 and W20064, had demonstrated their reliability in critical aircraft applications. They are built to MIL-S-6743 (Military) specifications.

You may not build automobiles, but you may have a special requirement which, like Lincoln Continental's, can be met directly from our line of hundreds of standard switches. Or CONTROL SWITCH can design and manufacture a unit to meet your exact needs. For more information, write for a free copy of our Condensed Catalog #100.

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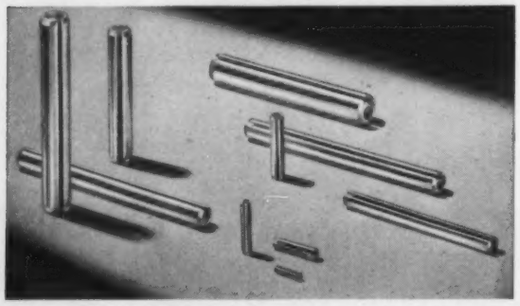

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- 60% the strength of carbon steel.
- 101 uses—as keys, axles, cotter pins, hinge pins, stop pins, pivots, etc.
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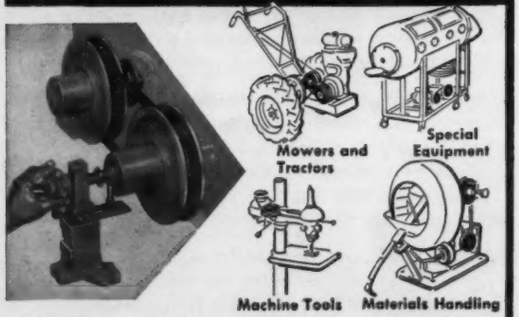

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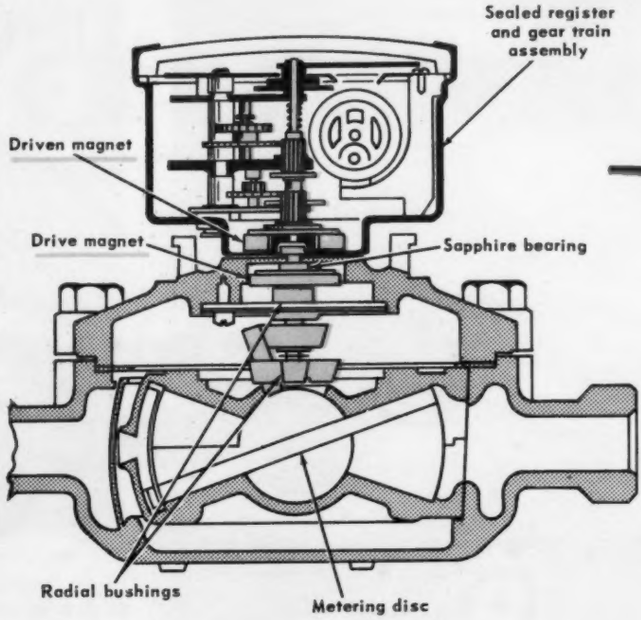
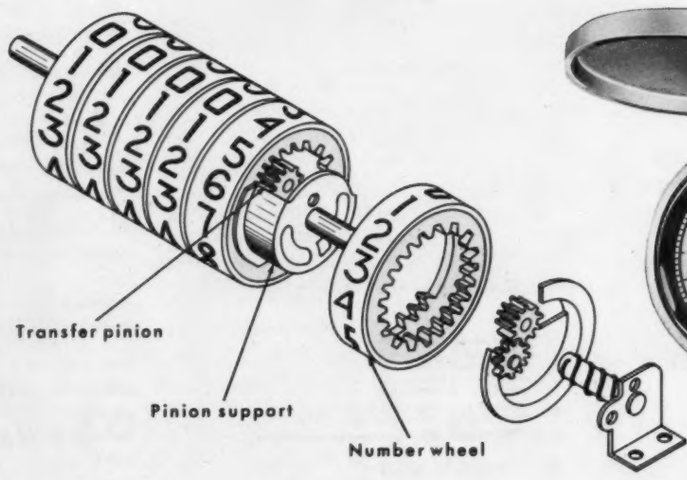
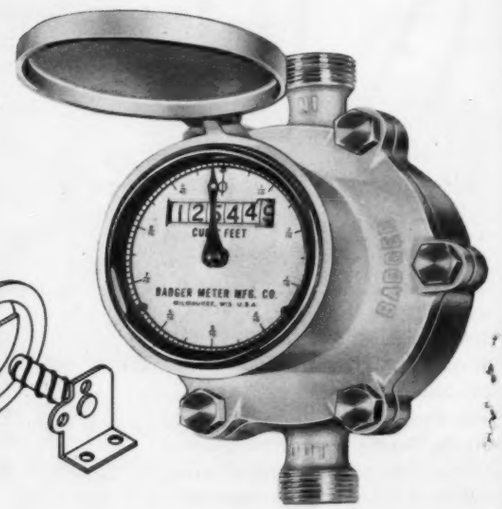
Ceramic Magnets Drive Sealed Water Meter Register

Lars G. Soderholm, Midwest Editor



CERAMIC MAGNETS transmit power through bronze walls separating measuring and register units. Flow of water through meter turns disc and lower drive assembly. Movement is transferred by magnetic couplings to gear-train and register unit.





TOTALIZER STACK is composed of molded plastic transfer pinions, pinion supports and number wheels—all molded of the same material.

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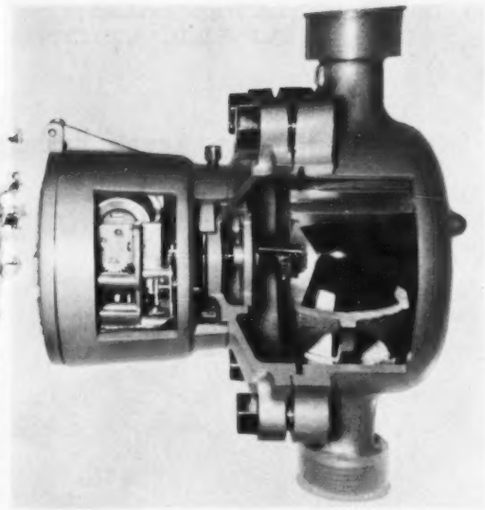

A new water meter design utilizes ceramic magnets to couple the driving lower chamber-disc assembly with a separate removable sealed gear-train register unit. An all-plastic, modular-constructed totalizer uses larger numbers and has an extra wheel for greater measuring capacity.

Advantages gained by using a magnetic coupling to drive a sealed register unit are primarily in the elimination of the stuffing box with its attendant leakage and drag on the system and the elimination of lens fogging. From a maintenance standpoint, the register can now be removed for replacement or servicing without shutting off the water. Existing meters can be converted by replacing the housing top and adding a new gear-train register assembly.

The magnets used in the coupling are four-pole face magnets. They are virtually impossible to demagnetize and will not corrode in service. These magnets provide a positive drive and have a torque capacity 30 to 50 times that required to operate the gear-train and register.

The drive magnet, located in the water chamber, runs against a sapphire jewel thrust bearing which is self-cleaning by nature of its position. The driven magnet in the register section runs on a tiny ball bearing to insure long life.

The removable register assembly is completely sealed in a bronze alloy container to eliminate galvanic corrosion with the cast meter housing. The lens is made of tempered glass. The register is attached to the meter by four mounting lugs on the lower housing body. The new water meter uses an extra wheel for a 10 million gallon capacity in all sizes.

The "Easy-Read" water meter is available in split-case or frost protective design in five sizes. It was developed by the Badger Meter Mfg. Co., Milwaukee, Wis.

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New

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- **Concentric configuration**
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- **Torques up to 21,850 lb.-ft.**
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- **Casehardened helical gears—ground after hardening for perfect engagement**
- **Reversible**
- **Progressive overload capacity to the extent that no breakage of gears can result even from the severest abuse**
- ***Ability to engage or disengage driving action —mechanically, pneumatically, hydraulically or electrically**
- ***Ability to provide load releasing, load limiting or overload alarm**
- ***Ability to provide 2-speed operation**

*Standardized accessories to provide these features are available for all sizes of Roto-Mission from stock. This results in a single responsibility for installation performance.

This new rotary transmission design combines a wide range of reduction ratios, high torque capacities, and excellent space-saving characteristics to give you more application versatility than ever before possible. It is designed to be concentrically mounted on a machine drive shaft in place of the drive pulley and operate this shaft at a reduced speed from that of the driving motor. For maximum compactness and convenience, all its parts are inside the casing.

The standard accessories available for each model of Roto-Mission add even greater versatility. Through them you have systems—from a single source—capable of control functions that previously required a number of unmatched units from several suppliers.

Because of its versatility and sound engineering, Roto-Mission permits you to solve design problems far beyond the range of other transmissions —may even permit incorporation of features in your machines that have not previously been possible. For complete information on this new product—how it operates and how it can help you —write today for Catalog IR-60.

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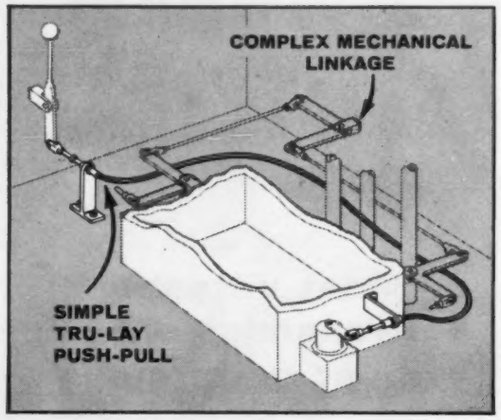
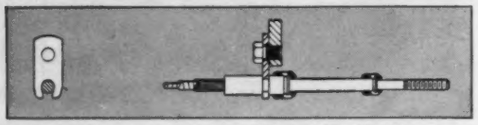
If your products involve remote control—electrical, hydraulic, pneumatic or direct—TRU-LAY PUSH-PULL FLEXIBLE CONTROLS can help solve your design problems. They provide positive remote control over short or long distances—up to 150 feet from the control point. Because they operate while flexing, they can snake around obstructions. They will not buckle. They are ruggedly constructed, easily installed and operated, sealed against dirt and moisture, and will handle jobs with as much as 1,000 lbs. input. PUSH-PULL CONTROLS are simple, have but one moving part, are noiseless and give a lifetime of accuracy. Mechanical linkages, on the other hand, are complex. Unlike PUSH-PULL CONTROLS, they are made of many parts, wear at many points, and produce increased backlash, vibration rattles and lost accuracy.

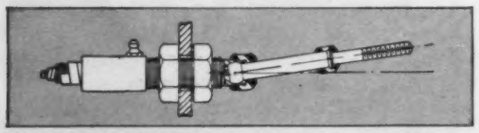


THESE FEATURES HELP SOLVE DESIGN PROBLEMS

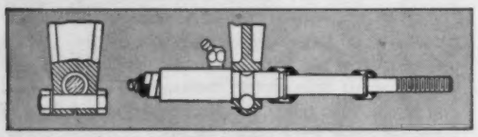
Anchorages



Clip anchorage • a simple clip for light loads

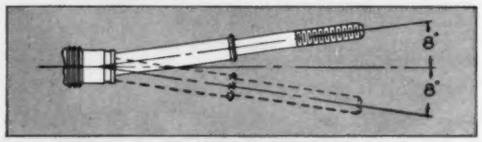


Bulkhead anchorage • for heavy-duty installations



Machined bracket anchorage • can be furnished for mounting any PUSH-PULL cable at the swivel terminal

Swivel Action



Standard assemblies have end fittings with a swivel movement of ± 8° to compensate for misalignment and rise or fall of lever arms. Swivel joints, and the sliding ends, are sealed against dirt and moisture.

***PUSH*-PULL DATA FILE SHOWS HOW TO SIMPLIFY, IMPROVE DESIGN**

• Write for your PUSH-PULL Data File. It contains a complete set of engineering bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages.

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Circle 55 on Reader-Service Card for more information

Nylon Housing, 'Lexan' Bushing

Victor W. Wigotsky, Eastern Editor

A new portable electric drill is a "double-insulated" unit. A nylon housing and insulation of the chuck with a "Lexan" bushing provides increased safety from electrical shock. Necessity for any additional grounding is eliminated.

The double insulation blocks any current leakage paths in event that primary insulation becomes faulty. All external metal parts must then be prevented from becoming electrically "alive". The chuck and switch-lock button were the two external metal parts of the drill to be considered, once the nylon housing was incorporated.

The chuck is isolated by making the internal gear of two elements. The gear is made from a high-grade alloy steel ring into which a "Lexan" bushing is press-fitted. The electrically nonconductive bushing, as the center of the gear assembly, prevents escape of any leakage currents that might develop and flow through the chuck. The bushing not only isolates the chuck, but also adequately withstands the normal torque and load requirements of the drill.

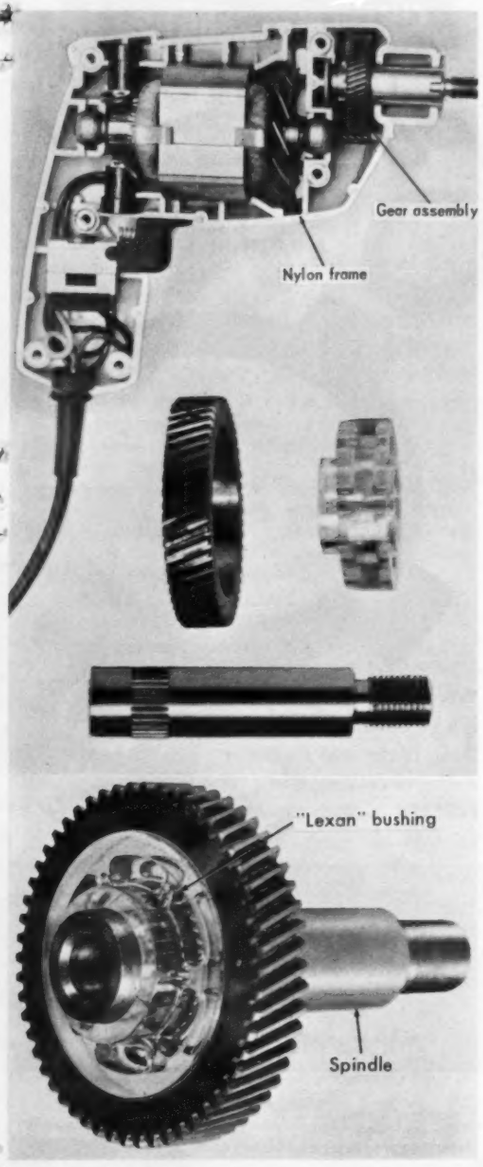
Instead of purchasing the lock-button integral with the switch, as was normally done, the lock-button is now made part of the tool housing. The exposed button is non-conductive "Delrin."

Nylon (Zytel 31) was chosen as housing material because of its dimensional stability, toughness and impact resistance, as well as its non-conductive electrical characteristic. Maintaining a uniform cross section of the two halves of the housing insures that the molded piece shrinks evenly, thus simplifying holding of dimensions.

The new tool thus will be acceptable by Underwriters' Laboratories with a two-conductor cord only.

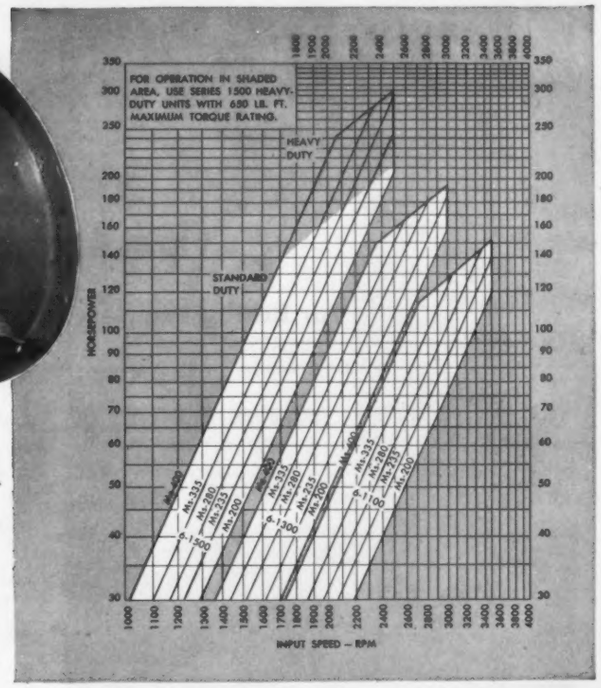
The Model 1144, ¼-inch Safe-T Drill was designed by Millers Falls Company, Greenfield, Mass.

Insulate Portable Drill



INTERNAL COMPONENTS with normal primary insulation are enclosed in non-conductive housing for secondary insulation. Air ports in handle and forward section of drill, together with baffle in fan area, compensate for lesser heat radiation of nylon housing, as compared to metals. Front and rear armature bearings are of spherical self-aligning type. Removing part of nylon from bearing areas permits heat dissipation to atmosphere and exposes bearings to additional air flow.

TWIN DISC
Torque Converters

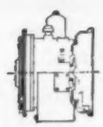

FOR OPERATION IN SHADED AREA, USE SERIES 1500 HEAVY-DUTY UNITS WITH 650 LB. FT. MAXIMUM TORQUE RATING.
HEAVY DUTY
STANDARD DUTY
HORSEPOWER
INPUT SPEED — RPM

This chart gives horsepower and speed ratings for all Twin Disc Single-Stage Converters. Note that the 1500 Series is furnished in standard and heavy duty capacities. The figure "6" preceding the series number refers to the type of circuit.

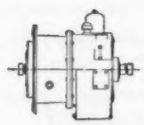
"Stripped" or cartridge-type units for OEM in-line design
Nine models—11", 13" and 15" sizes.
Torque ratings from 235 to 650 lb.-ft.
Three types: Converter only; converter with oil-actuated disconnect clutch; and converter with disconnect clutch and lock-up direct drive clutch.

Basic power take-off units
Three models—13" and 15" sizes.
Torque ratings from 350 to 650 lb.-ft.
Suitable for side loads.

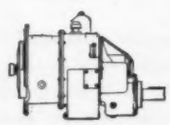
Spacer units for connection to transmissions
Three models—13" and 15" sizes.
Torque ratings from 350 to 650 lb.-ft.
Flanged output shaft.
Available with dummy flywheel for automotive type clutches.



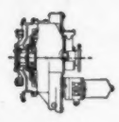
Units equipped with front-end disconnect clutch
Four models—13" and 15" sizes.
Single or double plate clutch.
Torque ratings from 350 to 650 lb.-ft.
Suitable for side loads.
Optional: Boom lowering freewheel for shovels and cranes.



Units equipped with disconnect clutch plus 2:1 ratio reduction gear
Three models—13" and 15" sizes.
Single or double plate 11" clutch.
Torque ratings from 350 to 650 lb.-ft.
Suitable for side loads.
Optional: Boom lowering freewheel.



Sumpless PTO units for power-shift transmissions
Three models—13" and 15" sizes.
Live power take-off for auxiliary drives.
Torque ratings from 350 to 650 lb.-ft.
Flanged output shaft.
Optional: Rubber block input drive.



SINGLE-STAGE TORQUE CONVERTERS

25 models

Virtually any single-stage torque converter requirement can be met with one of Twin Disc's standard rotating-housing units. The scope of the Twin Disc line can be seen from the summarized listing at left.

Each converter size—11", 13" and 15"—has five interchangeable impellers which vary with respect to blade number and pitch so that each has a different torque absorption capacity. This exclusive Twin Disc design feature provides a 2:1 horsepower spread for each converter series. It insures correct matching of converter to engine and also permits a subsequent increase in engine horsepower without dimensional changes in the torque converter.

Twin Disc Single-Stage Converters are available as "industrial" (self-contained) units or as "stripped" (cartridge type) units for incorporation into OEM transmission designs. Complete details are contained in Bulletin 510. For your copy, write TWIN DISC CLUTCH COMPANY, Hydraulic Division, Rockford, Illinois.

Circle 56 on Reader-Service Card for more information

DESIGN DATA NEWS

Flow Area Equations

For Rating Poppet-Type Valve Capacity

D. J. Lapera, Design Engineer, Marotta Valve Corp., Boonton, N. J.

The first consideration made in most cases of valve design is the valve element size necessary to obtain a predetermined valve capacity rating for some specific application. Other equally important considerations such as temperature, material in contact with line fluid, life and method of actuation usually follow. This article deals with calculating area of flow through the seat of one specific type of valve element, and how, in most cases, this flow area may be used to rate the capacity of the valve. The type to be discussed is a poppet-type valve stem sealing in a conical seat (Fig. 1).

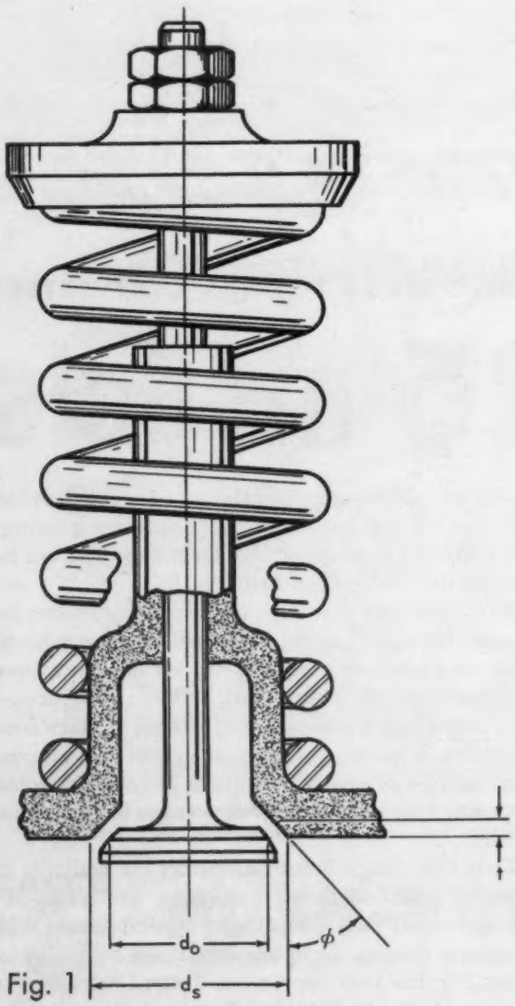


Fig. 1

When a valve stem is moved away from its seat, the change of area was found experimentally to be:

$$\frac{dA}{dt} = C(2t + d_o)$$

Where:

"C" = a trigonometric function of the cone angle of the seat.

With valve stem and seat geometry presenting conditions similar to those shown in Fig. 1, the flow area through the valve seat is the surface area of a frustrum of a right circular cone. To utilize this relationship, the following condition must be met:

$$d_s \geqslant t \sin 2\phi + d_o$$

Derivation of the equations was made on the basis of the generated surface area integral, which is in general:

$$A = \int_a^b 2\pi y \sqrt{1 + (dy/dx)^2}\ dx$$

In adapting this general form to the case in question, geometrical substitutions were developed as shown in Fig. 2. Substituting into the general form we have:

$$A = 2\pi \int_{x=0}^{x = t \sin^2\phi} (x \cot \phi + \beta) \sqrt{1 + \cot^2 \phi}\ dx$$

Integrating between limits and simplifying yields the basic area equation:

$$A = \pi t \sin\phi\ (t \sin\phi \cos\phi + d_o)$$

For convenience, this equation was reduced for $\phi = 45$ deg:

$$A = 1.11t^2 + 2.22td_o$$

$$d_o = \frac{0.45A - 0.5t^2}{t}$$

$$t = 0.945 \sqrt{1.115d_o^2 + A} - d_o$$

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HIGH TEMPERATURES . . .
CHEMICAL CORROSION ?

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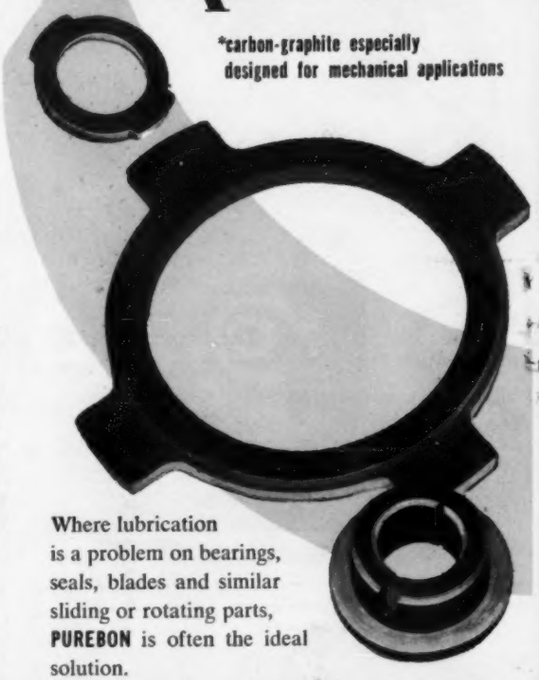

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UE TYPE J6
PRESSURE & VACUUM CONTROL

UNITED ELECTRIC TYPE J6 unit is designed to automatically control either pressure or vacuum . . . has a fixed, uniform on-off differential as specified between limits of 3" WC to 2 PSI . . . and a maximum controlling pressure of 180 PSI. It is a sensitive, weatherproof, precision built control with good repeatability. Recommended for all pressure or vacuum applications which require close on-off differential control.

Switch Differential	Fixed as specified between limits of 3" WC to 2 PSI.
Switch Ratings	15 or 20 amps at 115 or 230 volts AC, also DC switches upon specification.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Size	4¾" x 4 27/32" x 2 5/16".
Weight	Approx. 1 lb. 8 oz.
Electrical Connection	½" NPT conduit opening in enclosure, screw type terminals on switch is standard.
Enclosure	Die-cast aluminum case, black wrinkle finish standard.
Mounting	Surface mounted—by 2 mounting ears.
Bellows	Seamless brass—spring loaded.
Pressure Connection	¼" NPT female connection.

UNITED ELECTRIC *manufactures a complete line of temperature, pressure and vacuum controls. UE will gladly modify or custom-build a unit to your specifications. Consult a UE application engineer today.*

Write for Bulletin No. 5-3 for complete J6 data.

United Electric Controls COMPANY
85 SCHOOL STREET, WATERTOWN, MASS

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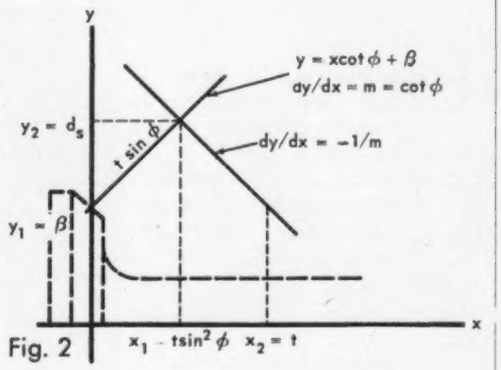

Fig. 2

The above equations are graphically represented in Fig. 4. As mentioned previously, the capacity of a valve may be determined on the basis of the calculated flow area, if a choice of capacity equivalence is made. Those most widely in use in manufacturer's catalogs are:

1. Equivalent Sharp Edge Orifice Diameter (D_o) for which $C_{Do} = 0.60$
2. NBS Flow Factor (F)
3. Flow Coefficient (C_v)

Defining any one or all three of the above capacity ratings as a function of flow area in a valve requires the use of two flow equations that have proved reliable through numerous test comparisons.

For imcompressible volume flow (scfm) expressing D_o as an independent variable we have:

$$Q = 31.6\ C_{Do}\ D_o^2$$

and since $C_{Do} = 0.6$ when D_o is defined:

$$Q = 18.96\ D_o^2 \sqrt{\frac{\Delta P}{\rho}}$$

An equivalent equation expressing flow area as an independent variable is:

$$Q = 40.1\ A\ C_D \sqrt{\frac{\Delta P}{\rho}}$$

In this case, C_D must be assumed on the basis of the geometry of the unit from which A was calculated. Equating the two equivalent equations

$$18.96\ D_o^2 \sqrt{\frac{\Delta P}{\rho}} = 40.1 A\ C_D \sqrt{\frac{\Delta P}{\rho}}$$

Simplification yields:

$$D_o = 1.45 \sqrt{A\ C_D}$$

Converting from one capacity rating to another is obtained from the below equations:

$$D_o = 0.338 \sqrt{\frac{F}{\theta}} \sqrt{\frac{Q_u}{F}}$$

$$C_v = 17.9\ D_o^2$$

$$F = \frac{D_o^2\ \theta}{0.114\ (Q_u/F)}$$

(Continued on next page)

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Typical Clare mercury-wetted relay steel-enclosed modules for circuit-board mounting. From top: HGSM Relay Module, HGM Relay Module, HGPM Relay Module. Epoxy molded Relay Modules are also available.

Mercury-wetted contact relays, steel-enclosed and ready for mounting on your own assembly line, give you Clare reliability in operation, combined with new ease of application and handling. Clare HG and HGS relays have test records of over 10 billion operations, without maintenance or change in characteristics. In these new modular cases, they're sturdy, magnetically shielded, easily replaceable.

Choose either the standard Clare HG relay, or the HGS—super-fast and super-sensitive. You'll gain extra convenience and increased component-density with these Clare Relay modules.

Each relay contains one or more of these magnetic switches. Mercury-wetted contact surfaces are continually wetted by capillary action; they never bounce, never get dirty, never weld, and never wear out.

Get Bulletin CPC-8 for detailed specifications, characteristics, dimensions: Ask your Clare representative, or address C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare Canada Ltd., 840 Caledonia Road, Toronto 19, Ontario. Cable address: CLARELAY.

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Relays and Related Control Components

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Flow Area Equations . . . Cont.

Fig. 5 converts any one known capacity rating directly into the other two. It should be remembered, however, that since the conversion of D_o to F, or vice versa, involves pressure ratio functions (θ and Q_u/F), the chart conversion is to be used as an approximate value only. Conversion of D_o to C_v or vice versa is correct to within chart accuracy.

Nomenclature:

β = $d_o/2$ (seat radius), inches
t = poppet travel from seat, inches
d_o = seating diameter of poppet, inches
d_s = diameter of large end of cone, inches
ϕ = 1/2 conical seat included angle, degrees
A = flow area through valve seat, sq in
Q = volume flow, scfm
C_D = coefficient of discharge
D_o = equivalent sharp edge orifice diameter, inches
ΔP = pressure drop ($P_u - P_D$), psi
ρ = fluid density at standard conditions, psi
F = NBS flow factor, scfm/psia
P_D = downstream pressure, psia
P_u = upstream pressure, psia
$\theta = \psi/\psi_{max}$
$\psi = \sqrt{(\gamma/\gamma - 1)(r^{1/\gamma})(r^{1/\gamma} - r)}$
$\psi_{max} = (2/\gamma - 1)^{1/\gamma - 1}\sqrt{1/\gamma + 1}$
r = pressure ratio, (P_D/P_u)
γ = ratio of specific heats
C_v = flow coefficient, $gpm/\sqrt{\Delta P}$
$Q_u/F = 1.263\sqrt{r(1 - r)(3 - r)}$

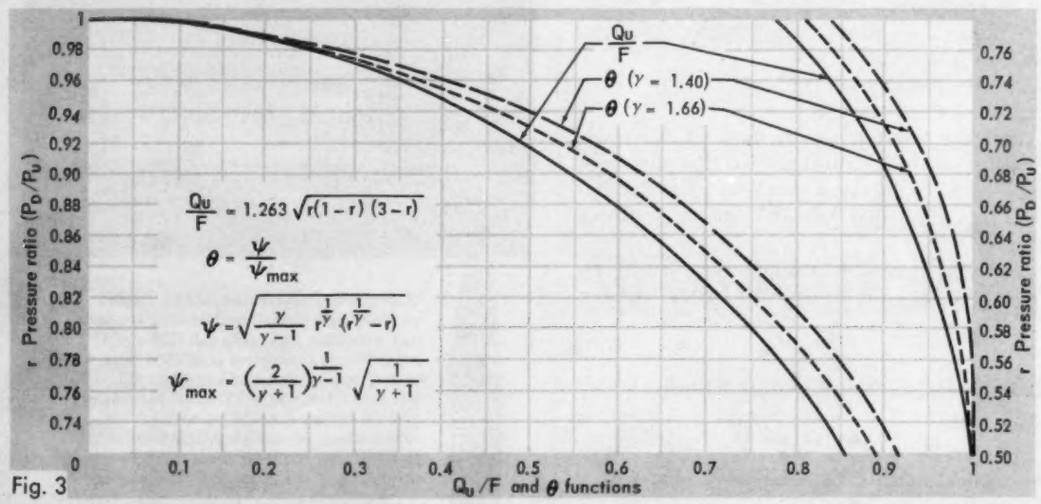

Fig. 3

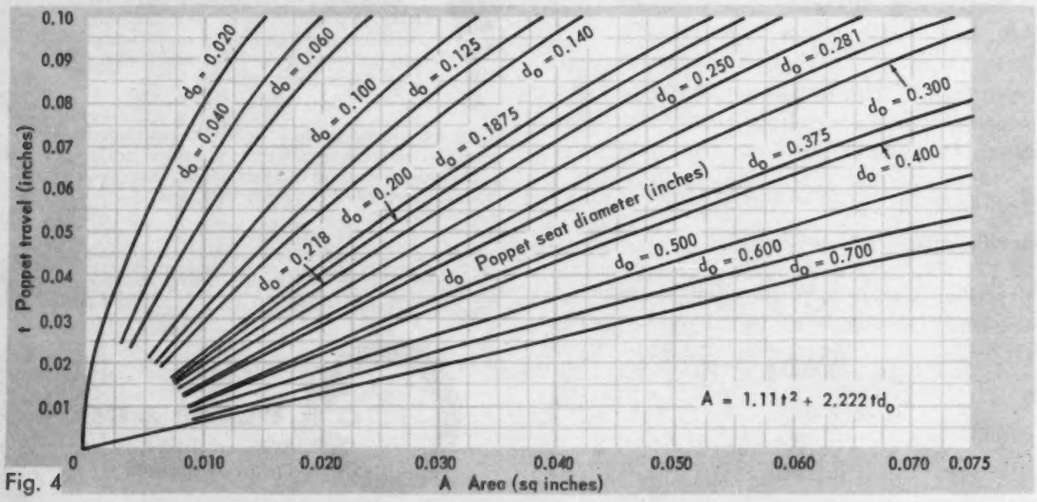

Fig. 4

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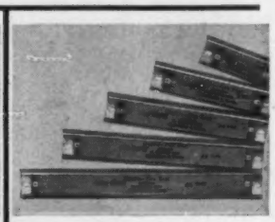

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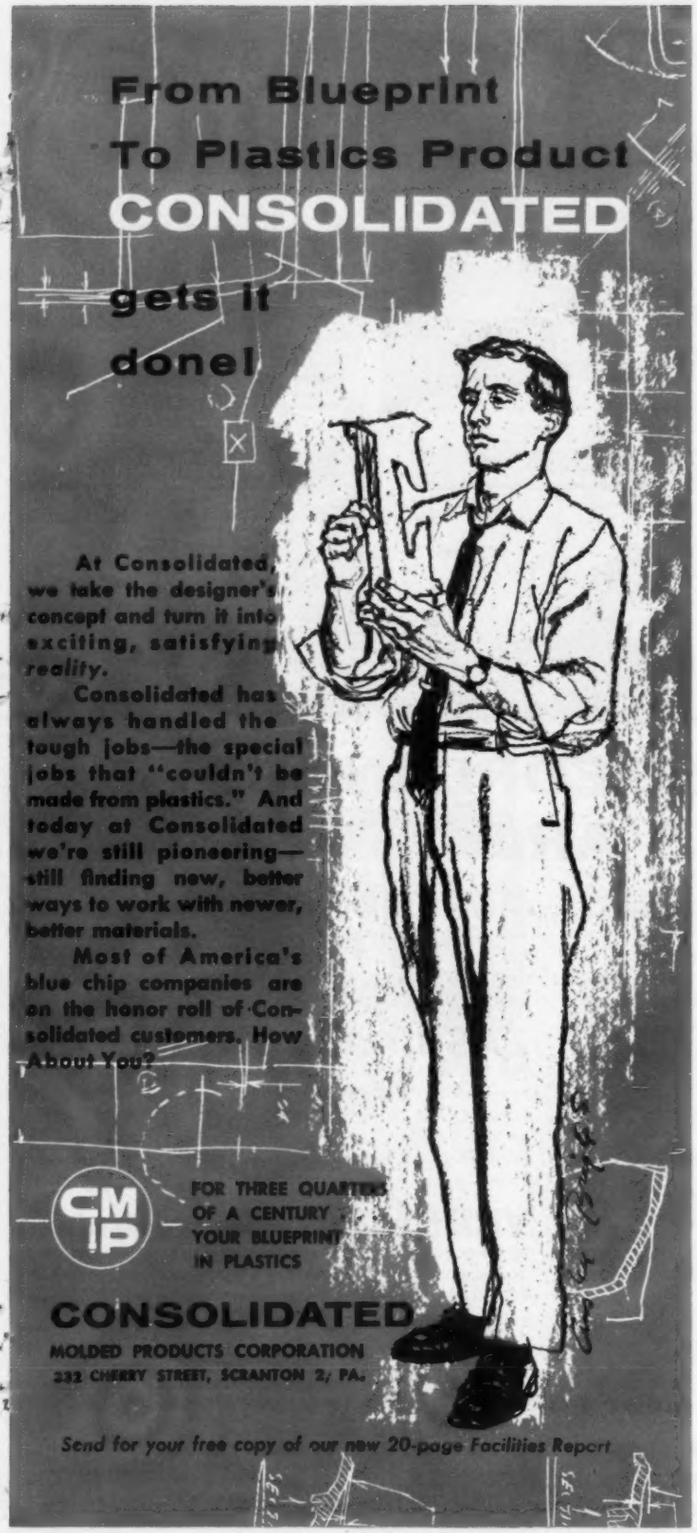
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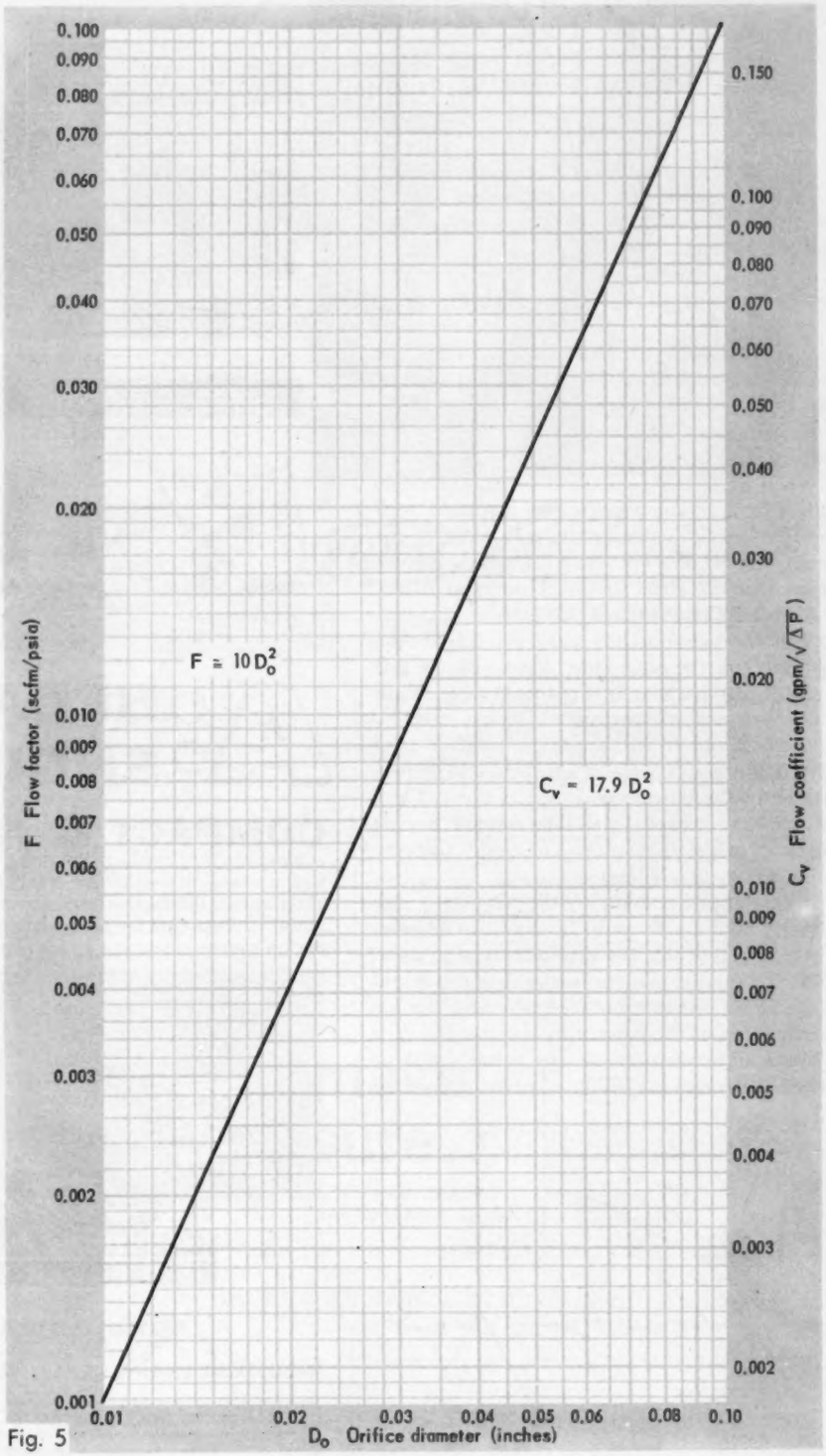

Fig. 5

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An Optical Aid To Drawing Tangents

Robert G. Greenler, Research Laboratories,
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

It is sometimes useful to determine by a graphical method the slope of the tangent at various points of an empirical curve.

A short equilateral prism has been used as a method for graphically determining the tangent of a curve, but this method has an inherent limitation which restricts its accuracy. For those cases where a modification of the direct method (laying a straightedge along the curve) is desirable, better methods exist.

Method I

When using the equilateral prism, the prism (as shown from above in Fig. 1a) is rotated until the line segments seen in the two sides of the prism meet at the center of the prism. Fig. 1b shows that the effect of the prism is to reduce the length of line segment AB seen through one-half of the prism to the apparent length AO. Similarly, on the other side of the prism a line segment A′B′ is apparently reduced to the length A′O.

Points B and B′ will appear to coincide at O only if the vertex edge of the prism is perpendicular to the line which connects them. Thus, the tangent derived from this method is only the chord of a segment of the curve which has the point, O, as its midpoint.

If this approximation to the tangent is sufficiently accurate, it could be drawn more readily directly with the use of compass and straightedge. If a smaller prism is used, the points B and B′ lie closer together on the curve and the approximation of the tangent by the chord B B′ is a better approximation. As the prism size is reduced, however, the accuracy of matching the

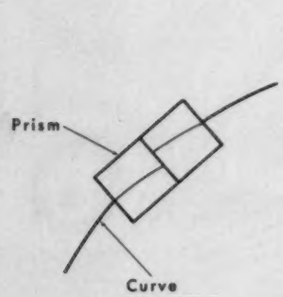

Fig. 1a

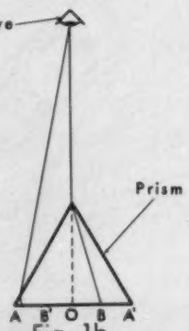

Fig. 1b

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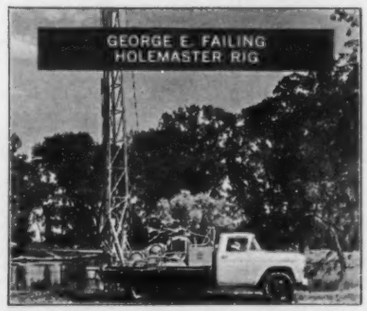

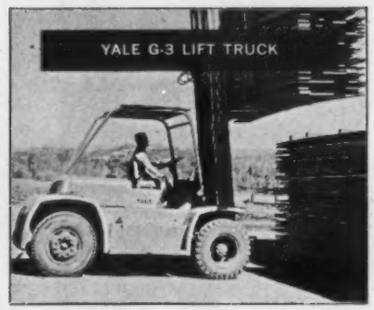

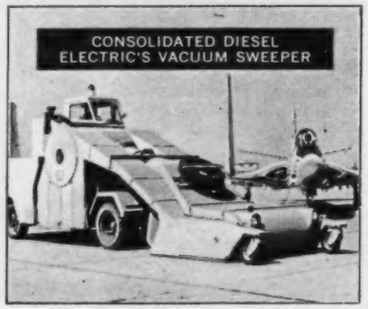

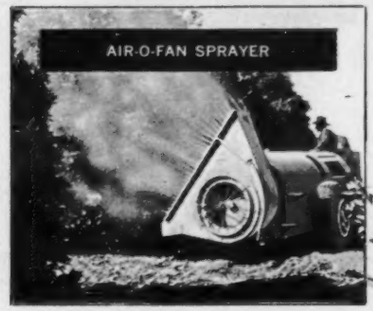

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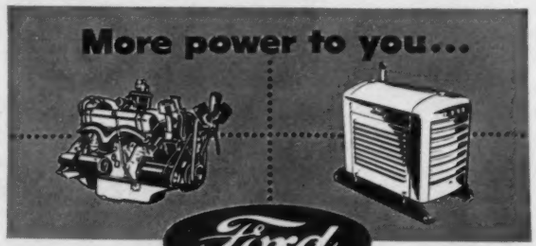

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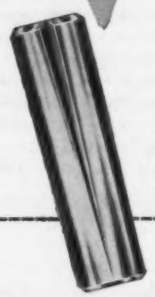

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points B and B′ at O by rotating the prism is reduced correspondingly. This method is inaccurate when the curvature varies along the curve and it is under this condition that an aid to drawing the curve tangent or normal is most useful.

Method II

A better method which has been used for this purpose is illustrated in Fig. 2. A front-surface mirror is placed across the curve, held approximately perpendicular to the plane of the paper, and rotated so that the curve and its reflection in the mirror appear to form a smooth curve. The surface of the mirror in this position defines the normal to the curve at the point where the mirror intersects the curve.

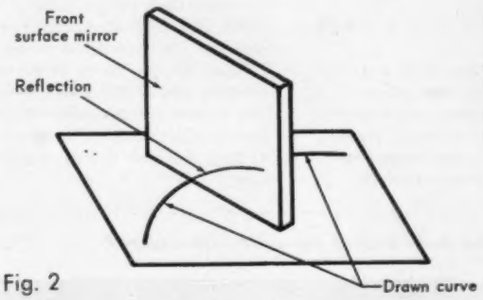

Fig. 2

Method III

Another method is illustrated in Fig. 3. A block of clear plastic with a sanded base is placed over the curve. A glass prism which has a ground surface perpendicular to a polished face is also quite satisfactory. Looking into the plastic block through a vertical face, a reflected image of the curve and also the portion of the curve covered by the block are seen. The prism is rotated until these two curves appear to be tangent to each other at the surface of the block and connect smoothly to the curve outside the block. In this position the edge of the block defines the normal to the curve.

In the case where the curvature of a curve varies only slightly, the direct method of using a straightedge may be preferred.

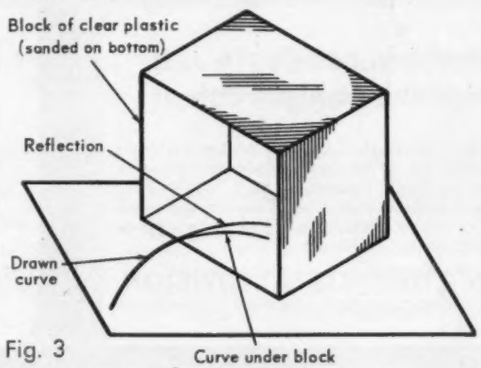

Fig. 3

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Bonding Films 452

Actual samples of more than 40 adhesive bonding films. This catalog is invaluable to engineers concerned with a quick method of selecting the proper film for hundreds of bonds. Girder Process, Inc., 102 Hobart St., Hackensack, N. J.

Aerospace Materials 453

Structural materials for aerospace applications are discussed in an 8-page booklet. Development facilities for pure metals, alloys, ceramics and plastics are described in the publication, along with examples of some long-life space-structure components that have been produced. Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

Tracing Templates 454

A set of full-scale tracing templates that were designed for companies who manufacture jigs, fixtures and special machinery. It includes over 200 components used by the industry most often. Tool designers will use these templates to select the correct proportioned items for their designs. Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.

Nylon Fasteners Specifications 455

Standard specifications for nylon molded threaded fasteners. These specifications cover the six head types available for nylon machine screws: round, binding, oval, washer, flat and fillister; and the six point types available for nylon headless set screws: plain, oval, cone, flat, half dog and full dog. Sheet gives complete details on threads and principal dimensions for all head types. Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.

Miniature Connectors 456

A 44-page, comprehensive, precision miniature connector catalog. Complete description, illustrations, electrical and mechanical specifications, dimensional drawings and ordering information are included. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Electronic Components 457

This 1961 catalog, 324 pages, gives complete product and price information on the comprehensive selection of over 20,000 items. It is completely indexed by product and manufacturer. Represented in the catalog are 158 manufacturers. Special indexes list new products and new stereo components. Thurow Electronics, Inc., 121 S. Water St., Tampa, Fla.

Drafting Aids 458

An illustrated 4-page bulletin describing the model 3300 drafting machine, with special emphasis on the 20-inch arm model which covers a drawing area up to 34 by 44 inches. Specifications for this as well as the 16-inch and 18-inch arm models are included, together with a section on scales available for these machines. V. & E. Mfg. Co., 766 S. Fair Oaks Ave., Pasadena, Calif.

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A 12-page engineering report explains in detail how to calculate the effectiveness of a partition or sound barrier. The booklet treats building walls, movable office partitions, machinery enclosures and other sound-containing structures. The method of analysis shown in the booklet demonstrates some surprising facts. Lead Industries Association, 292 Madison Ave., New York 17, N. Y.

Self-Locking Fasteners 460

A 4-page engineering data bulletin. Contained in the bulletin are design characteristics of self-locking bolts and screws, a table of torque testing per MIL-F-18240 specifications and temperature-strength data. Shown also are physical test data and typical applications. Long-Lok Corp., 2601 Colorado Ave., Santa Monica, Calif.

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Military Terminal Boards 463

Technical bulletin No. 61-3 containing all electrical and mechanical specifications of military terminal boards. The bulletin consists of 8 pages, including a quick-selection table, all drawings with important dimensional information, details on available hardware and accessories. Kulka Electric Corp., 633-643 S. Fulton Ave., Mt. Vernon, N. Y.

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Low-Voltage Components 469

A 92-page catalog covering low-voltage distribution equipment. Designed to serve as a condensed buying catalog for products of two G. E. departments, the "Buy Log" provides complete buying information on heavy-duty safety switches, CLF current-limiting fuses, hinged wireway, circuit breakers, switchboards, motor control centers, power distribution centers and all types of panelboards and busway. Among the many features of this useful publication are: product selector charts, descriptions, consolidated pricing tables and a catalog number index. Also, ratings, weights, dimensions, standard package quantities, ordering directions and general applciation information. General Electric Co., Distribution Unit, Plainville, Conn.

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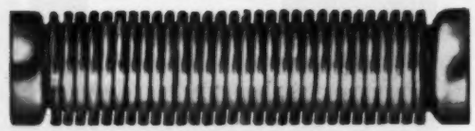

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Induction Motors 471

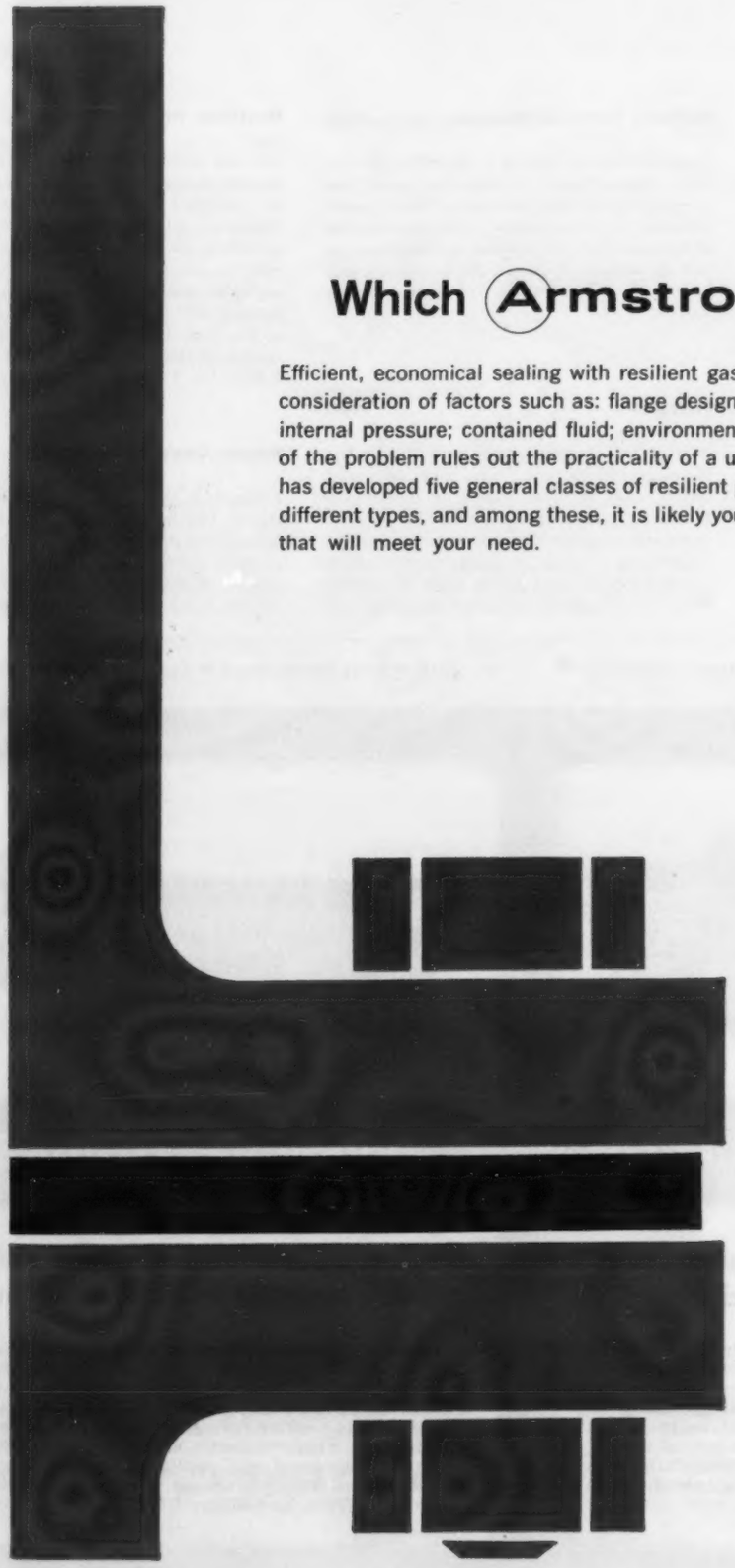
Electrical and mechanical features are described on redesigned, guarded drip-proof motors in NEMA standard dimensioned frames 182 through 445U. Fairbanks, Morse & Co., Electrical Div., 303 N. Henderson, Freeport, Ill.

Transducers 472

"Mechanical-To-Electrical Transducer" is the title of a descriptive treatise on the REGOHM transducer. It summarizes a new design approach in a component used for control of such quantities as position, tension, speed, weight and others. Special emphasis is placed on the problem of how to convert small mechanical change (down to 0.0001 inch) into electrical control action on the ¼-kw level without complex and costly amplifiers. Illustrated with photos and drawings, three aspects of the transducer are described: applications, operating principles and design considerations. One highlight is a cutaway illustration of the device to reveal how an extremely wide operating spectrum is attainable in a compact transducer. Electric Regulator Corp., Pearl St., Norwalk, Conn.

Instrument Tubes 473

Describes characteristics and uses for CBS instrument tubes which are manufactured specifically for instrument manufacturers. The brochure describes frame grid tubes and secondary emission tubes which are a part of the new instrument-tube line. Broadcasters, test equipment manufacturers, builders of industrial instrumentation and all those interested in reliable, long-life versions of many commonly used receiving-tube types should find the information in this brochure most useful. CBS Electronics, Technical Information Services, 100 Endicott St., Danvers, Mass.



Which Armstrong resilient gasket

Efficient, economical sealing with resilient gasket materials begins with consideration of factors such as: flange design; flange pressure; temperature; internal pressure; contained fluid; environment; price. Because the complexity of the problem rules out the practicality of a universal material, Armstrong has developed five general classes of resilient gaskets. They include 48 different types, and among these, it is likely you will find one or more that will meet your need.

Accopac— asbestos fiber

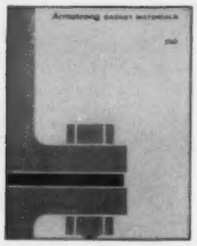
Synthetic rubber

Accopac— cellulose fiber

Cork-and-rubber

Cork compositions

for your job?



Send for new catalog

This new 20-page booklet contains detailed information on the broad line of Armstrong resilient gasket materials.

Refer to it in Sweet's product design file or send for a free personal copy. Write to Armstrong Cork Company, Industrial Division, 7101 Ithaca Street, Lancaster, Pennsylvania.

These are beater-saturated combinations of asbestos fiber and nitrile-, styrene-, or chloroprene-type latex binders. Free of undispersed clumps of fibers, they are unusually uniform, tough, flexible, and easy to handle even in 1/64" gauge. Torque retention characteristics and resistance to extrusion are excellent. For this reason, Accopac asbestos materials are widely used in heavy-duty applications at temperature range of cellulose materials (up to 300° F.) as well as in the normal range for asbestos gaskets (300° F. to 800° F.).

These are special formulations based on a variety of standard synthetic polymers, including silicone and fluorocarbon types. They provide a wide range of hardness, elasticity, and tensile strength.
Straight rubber compounds are extensible and non-compressible, suitable for applications where the gasket must be assembled over a projection or where it must flow into threads or recesses. These materials have generally good resistance to solvents, oils, water, heat, oxidation, sunlight. Low compression set.

General-purpose beater-saturated fiber materials. Synthetic latex binders (nitrile-, styrene-, or chloroprene-type rubber) are non-volatile and non-extractable in any recommended application. Accopac materials are dimensionally stable, will not warp, shrink, or dry out.

These materials offer the double economy of long service life and low initial cost.
Six Accopac cellulose materials are available. They accommodate a wide range of unit loads and sealed fluids, at flange temperatures up to 300° F.

These materials provide a transition from the compressibility of cork composition to the non-compressibility of straight rubber. Will compress from 20% to 33% without excessive sideflow, depending on cork content of particular compound. Fifteen Armstrong cork-and-rubber materials are available. These compounds are made with nitrile-, styrene-, chloroprene-, or butyl-type binders. Chemical resistance is comparable to corresponding base polymers. Several types meet MIL-G-6183 and other specifications.

Widely used general-purpose gasket materials. Available with resin or protein binders or a new, continuous phase elastomeric binder (Uniphase Cork). Density varies from 14 to 28 lbs. per cu. ft., and compressibility varies from 5% to 50% at 100 psi depending on composition. (Nine Armstrong compounds available.) Cork compositions are compressible without appreciable sideflow. They have excellent resistance to oil and solvents and have high friction whether dry or wet. The Uniphase compounds are virtually fungusproof.

Armstrong GASKET MATERIALS

Specialized Fasteners 474

A 4-page brochure detailing a specialized fasteners service offered by the manufacturer. The back page features a group of 62 fasteners, each numbered and each description correspondingly numbered for ready reference. Mid-America Fasteners, Inc., Franklin Park, Ill.

Relays 475

A 16-page catalog showing complete line of electromagnetic relays. Contains comprehensive engineering data on 42 different series of relays, divided into 4 major groups: telephone-type, military, power and general purpose. Most of the information is presented in the form of charts. Mounting data and descriptions of a wide variety of enclosures are given, as well as information on various terminals. Potter & Brumfield, Princeton, Ind.

Miniature In-Line Filter Assemblies 476

Engineering bulletin No. 600 provides information on a miniature in-line filter assembly which has application wherever caustic and/or corrosive liquids or gases are being handled. The unit is pictured and described. Engineering drawings and specification data are provided. Dumont Engineering Corp., 1401 Freeman Ave., Long Beach, Calif.

Wire Data 477

Wire for use in many phases of the semiconductor industry is the subject matter of this pamphlet. The 4-page brochure outlines important factors involved in maintaining the physical and electrical properties of the many metals and alloys used by the industry. Discussed at length are the various purities and properties of gold and doped-gold alloys as well as aluminum and doped aluminum wire. Secon Metals Corp., 7 Intervale St., White Plains, N. Y.

Universal Joints 478

Automotive and industrial universal joints are the subject matter of this 218-page catalog. The literature covers a wide range of general engineering data concerning universal joints, as well as descriptions and complete joint specifications, servicing instructions and ordering information. Mechanics Universal Joint Div. of Borg-Warner Corp., 2020 Harrison Ave., Rockford, Ill.

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TECHNICAL PAPERS

Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

STRUCTURAL TESTING AT HIGH TEMPERATURES; *L. Young, Lockheed Aircraft Corp., Burbank, Calif.; SESA No. 552.*

Equipment and procedures used in testing a large multicell box beam under various combinations of applied loading and transient heating. Data are presented on the performance of radiant heat lamps when enclosed by aluminum reflectors and powered by automobile-type batteries. Solutions are given to sealing the specimen without disturbing the normal paths for heat flow and protecting strain gages and thermocouples from simulated fuel.

VISCOUS SHEAR TORQUE IN FLOATED GYROSCOPES; *J. F. Bellantoni, Sperry Gyroscope Co., Div. of Sperry Rand Corp., Great Neck, Long Island, N. Y.; ASME No. 60-AV-47; 80 cents; to ASME members, 40 cents.*

The drift torque produced by the viscous sheer of free-convection currents in a floated gyroscope is estimated for an arbitrarily shaped gyro that is enveloped by a shell of fluid. The steady-state torque on the gyro is obtained in terms of the temperature distribution, coefficient of thermal expansion and geometry of the fluid. Calculation results for the cylindrical and spherical cases are given and a rough approximation to the transient-state flow is made.

THEORY AND APPLICATION OF THE PLASMA ARC; *R. M. Gage, Linde Co., Div. of Union Carbide Corp., Newark, N. J.; SAE No. T41; 75 cents; to SAE members, 50 cents.*

Plasma arc torches produce an arc plasma flame, which has two advantages by comparison to the conventional chemical flame of torches operating on oxygen and fuel gas. The temperature of arc plasma flames can be many times greater and their gas is of an arbitrary and controlled composition. The plasma-arc plating process and applications are discussed.

SPACE STRUCTURE DESIGN WITH COMPOSITE MATERIALS; *Hans Schuerch, Astro Research Corp., Santa Barbara, Calif.; ARS No. 1096-60.*

Identification of some general objectives that might be encountered in the design of advanced space structures and a review of possibilities vested in approaches involving composite structural materials. A discussion is included of typical problem areas associated with design with these materials.

FORCED LATERAL VIBRATION OF A UNIFORM CANTILEVER BEAM WITH INTERNAL AND EXTERNAL DAMPING; *Ho Chong Lee, Rensselaer Polytechnic Institute, Troy, N. Y.; ASME No. 60-APM-15.*

The steady-state response problem of a uniform beam with a sinusoidal shaking force at the base is studied. Beam material is the general linear substance represented by a model having an additional spring element in parallel with the Maxwell elements. The exact solution with a numerical example is given for one case where shear and rotary inertia effects are neglected. This result is compared with the solution obtained by a tabular method.

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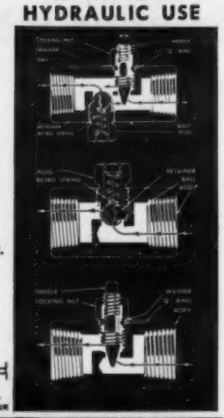

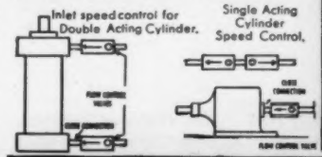

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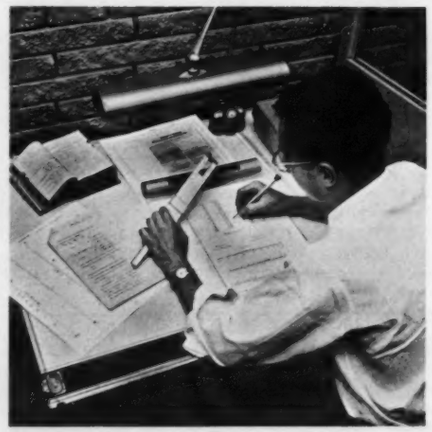

Illustrating

DESIGN DATA NEWS

PRODUCTION AND APPLICATION OF VINYL-COATED STEEL; *G. H. Rendel, United States Steel Corp., Monroeville, Pa.; SAE No. 180B; 75 cents; to SAE members, 50 cents.*

Vinyl-coated steel produced in a continuous process by the plastisol system combines the strength of steel with the decorative and functional attributes of vinyl plastics. Its excellent resistant to scuffing, scratching, abrasion and stain qualifies it for many applications. The product can be formed, drawn and joined by a variety of methods.

LUNAR OBSERVATION SYSTEMS; *A. L. Jones, P. L. Wickham and N. J. Ryker, North American Aviation, Inc., Downey Calif.; ARS No. 1197-60.*

Design considerations, development techniques and a development program for achieving a series of observatories on the moon for astronomical and astrophysical research. This series is shown to proceed progressively from the installation, first, of an unmanned remotely operated telescope, then to the first manned lunar vehicle with a telescope, and finally to a reasonably complete observatory.

APPLICATION OF INDUCTION HEATING TO SHORT-TIME ELEVATED-TEMPERATURE TENSION TESTING; *A. P. Levitt and A. G. Martin, Watertown Arsenal Labs., Watertown, Mass.; ASTM No. 74.*

Techniques and apparatus investigated and developed for conducting short-time elevated-temperature tension tests utilizing high-frequency induction heating. By this method, metal specimens are heated rapidly to a predetermined temperature and then loaded in tension. Tension test data were obtained at 600, 800 and 1000F on 120 plain and welded titanium alloy specimens. Results obtained are given and limitations and possibilities of the technique are discussed.

American Rocket Society, 500 Fifth Ave., New York 36, N. Y.
The American Society of Mechanical Engineers 29 W. 39th St., New York 18, N. Y.
American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.
Society of Automotive Engineers, Inc., 485 Lexington Ave. New York 17, N. Y.
The Society for Experimental Stress Analysis, Central Square Stn., Box 168, Cambridge 39, Mass.

Revolutionary new instrument cluster housing is made of **KRALASTIC**

The first complete instrument cluster housing to be made of plastic is now used by one of the nation's leading automobile manufacturers in all models of one of its new series. And look what KRALASTIC® offers!

1/5 the weight! These new KRALASTIC housings are 7 to 8 pounds lighter than those made with conventional materials, yet are tougher too!

What's more, they are molded to more intricate shapes, impractical with metals. They are rust-proof, sound-deadening, always warm to the touch. They have excellent dimensional stability, even at elevated interior temperatures exceeding 200° F. They provide better adhesion of the seven different acrylic lacquers used to match the cars' interiors. Chipping and marring are minimized, resulting in less touch-up during assembly. Hand-burring and finishing as with metal counterparts is materially reduced.

Most important, they have their own instrument wiring built into them, in the form of printed circuits. The single wiring plug is simply snapped into place to make contact with the circuitry printed on the back of the panel.

Individual wires to generator, oil, temperature, hi-beam and turn arrow indicators, gas gauge, and illuminating lights are eliminated. Manufacture, shipping and service are simplified as never before. Reliability is brought to an entirely new high.

And there's lots more to come from KRALASTIC, the original ABS plastic. With its unique combination of desirable properties, KRALASTIC is the key to a whole new series of design-engineering improvements, not only in automobiles but in products by the hundreds. Look into it.

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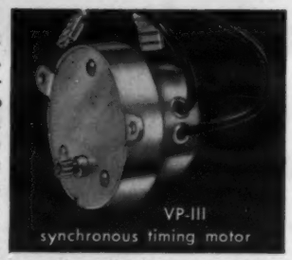
What's so uncommon

about this timer... or this one?

VC-300
variable-cam timer

GT-100
general-purpose timer



VP-III
synchronous timing motor

What's uncommon about these timers? It's the *motor*, the heart of any timing device, which is common to both. *Uncommon* because it is uniquely adaptable to unusual configurations. The VP-III motor offers extra reliability, too — with positive lubrication, heavy-duty gear train, and variable pole rotor. In addition to these versatile, reliable motors, other features of Lake-City timers merit careful consideration. The VC-300 variable-cam, for instance, is the only one made of corrosion-resistant *aluminum*. Less wear. Easier to adjust. VC-300 timers are available with up to ten 25-amp. circuits . . . for timing cycles from five seconds to several days. Or consider the GT-100 general-purpose timer — a single-circuit "work-horse" for anything from signs to systems. Speeds from 1/60 to 10 rpm, with 25-amp. DPDT or SPDT switch. Lake-City's VC-100 and VC-200 single-circuit variable-cam timers, too, use motors from the VP-III family.

Isn't there a product you could be improving . . . or a new idea you might be developing — right now — with these advanced motors or timers? Write for full information.

LAKE CITY, INC.
A SUBSIDIARY OF CONTROLS COMPANY OF AMERICA
CRYSTAL LAKE, ILLINOIS

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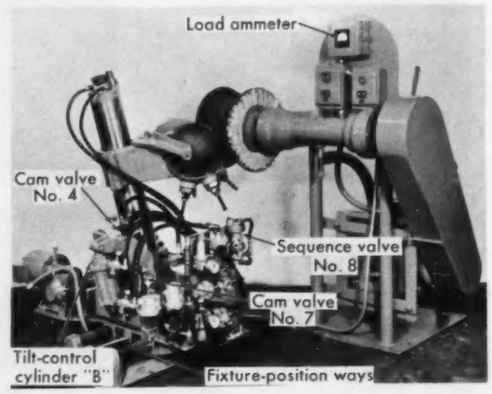
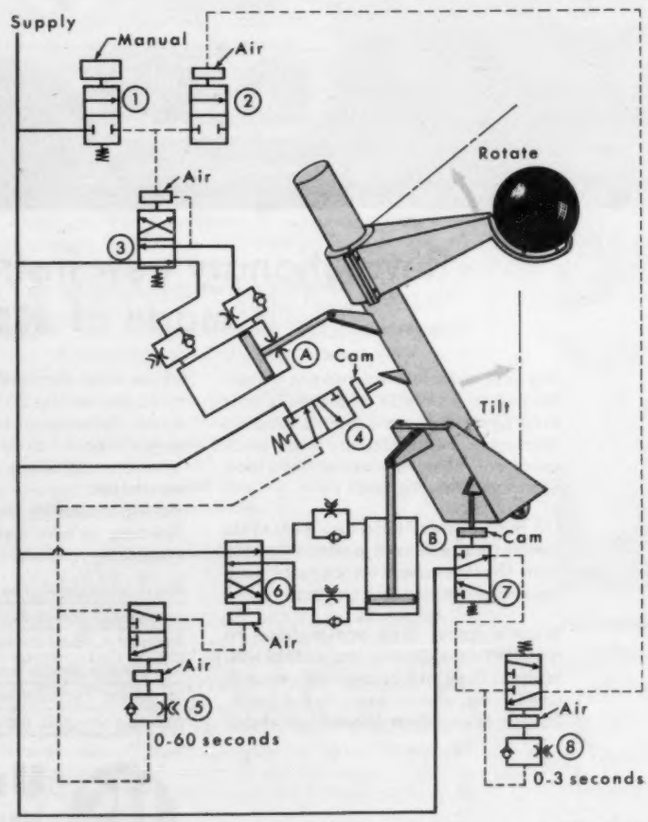
Pneumatic Circuit Controls Automatic Polishing

Robert L. Candlish, Detroit Editor

BALL-HOLDING FIXTURE IN LOAD POSITION. Fixture is tipped back to clear the polishing wheel and rotated 45 deg to one side. Ball is loaded by placing it in fixture between guide arms on four felt supporting pads positioned by adjusting screws in retaining tubes. Fixture rotates from load to polish position on preloaded taper roller bearings.





PNEUMATIC CONTROL CIRCUIT. Fixture is tipped back and rotated into load position.

1. Operator loads part and depresses manual valve 1, pressurizing head of valve 3.
2. Valve 3 opens, retracting cylinder A which rotates fixture out of "load" position.
3. Rotation contacts cam valve 4 which opens and pressurizes head of valve 6 through Normally Open valve 5. At same time head of sequence valve 5 is pressurized and valve 5 starts to time out.
4. Valve 6 actuates cylinder B, extending rocking fixture against polishing wheel sequence.
5. Sequence valve 5 times out and exhausts head of valve 6, causing it to reverse.
6. Cylinder B retracts rocking fixture from polishing wheel. Cam valve 7 opens and pressurizes head of valve 2 through Normally Open sequence valve 8. At same time valve 8 starts to time out.
7. Valve 2 opens and exhausts head of valve 3.
8. Valve 3 reverses and cylinder A retracts rotating fixture back to "load" position.
9. Valve 8 times out, actuates and exhausts head of valve 2 thus returning it to "start" position.
10. Repeat cycle.

For Free Reprints of the Above Article, Circle 532 on Reader-Service Card

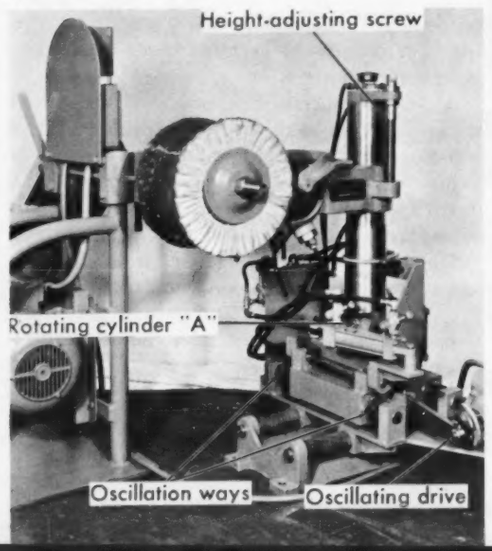
of Bowling Balls

A polishing machine that performs the final operations in production of bowling balls is completely controlled by a pneumatic circuit employing cam and sequence timing valves. Electrically-operated valves are not required. The ball-holding fixture is tipped back and to one side in the load position. Depressing the "start" button causes the fixture to turn facing the polishing wheel and then to advance into position against the wheel. During polishing the ball oscillates across the face of the wheel. Polishing wheel and oscillator-drive motor operate continuously.

The duration of the polishing cycle is controlled by a pneumatic timing valve. At the completion of the cycle fixture tips back out of contact with the wheel and rotates to the side for unloading. The roughing operation requires approximately 50 sec, the finish approximately 25 sec.

The bowling ball finish polishing machine was designed by the Murray-Way Corp., Birmingham, Mich. The pneumatic control circuit was engineered by the Ross Operating Valve Co., Detroit, Mich.

FIXTURE IN POLISH POSITION. Ball oscillates across wheel face at 15 cycles per min on ball bushing supports. Oscillation stroke may be varied from zero to 2.0 inches. Fixture also has in-out adjustment for wheel wear. Ball is not positively clamped and rotates slowly on pads.



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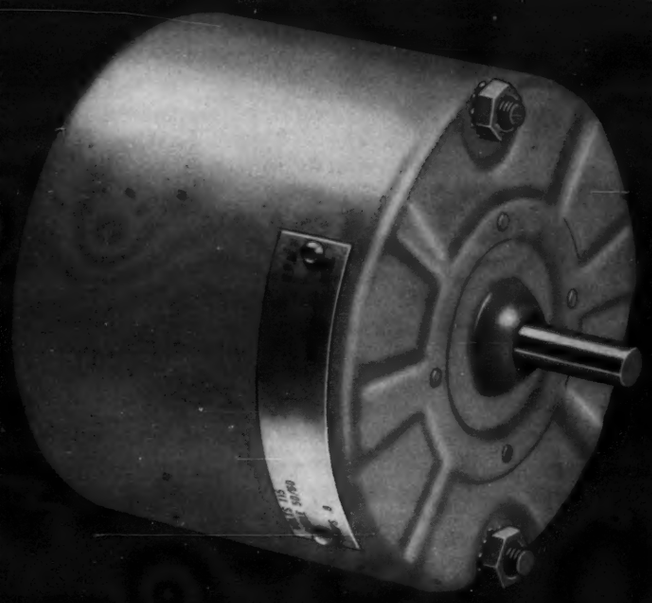

INDUSTRY STANDARD—3-1/4" Shaded Pole. 4 Pole—1550 rpm—1/150 to 1/25 hp. For use on fans, ventilators, small blowers, etc. Model No.4C.

Model No. 2A—Shaded Pole for small pumps, fans, ventilators, blowers. 2 Pole—3,000 rpm.

Model No. 4D—Shaded Pole for blowers, pumps, air conditioning. 4 Pole—1,550 rpm.

Model No. 6C—Permanent Split Capacitor for refrigeration, fans, blowers. 6 Pole—1,050 rpm.

Model No. 6D—Shaded Pole for air conditioners and blowers. 6 Pole—1,050 rpm.

Model No. 6E—Permanent Split Capacitor for room air conditioners. 6 Pole—1,050 rpm.

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SINCE 1909

LEECE-NEVILLE now offers you a complete line of shaded pole and permanent split capacitor motors—basic units adapted to your specifications, or special motors custom engineered to your requirements—with horsepower ratings from 1/150 to 1/2 hp. All L-N motors are capable of meeting U.L. and C.S.A. application tests. Leece-Neville has more than 50 years of experience manufacturing motors and other electrical equipment, and modern facilities assure not only top quality, but also delivery to your schedules and lead times. For full information, just mail the coupon at right.

The Leece-Neville Company, Dept. DN-2
Georgia Division, Gainesville, Georgia

Please forward details on your shaded pole and permanent split capacitor motors.

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(CARBON-GRAPHITE)

THE VERSATILE ENGINEERING MATERIAL THAT POSSESSES MANY UNIQUE AND PRACTICAL ADVANTAGES FOR A VARIETY OF APPLICATIONS

MINIMUM LUBRICATION REQUIRED—Because of the controlled porosity and non-melting nature of GRAPHITAR, the only lubricant GRAPHITAR bearings need is water or other low-viscosity fluid. Any such fluid with non-gumming characteristics will provide an extremely low coefficient of friction and assure long life of the GRAPHITAR parts.

RESISTANCE TO CHEMICAL ATTACK—GRAPHITAR has the ability to withstand the action of almost any chemical, with the exception of the most highly oxidizing re-agents in hot and concentrated form. GRAPHITAR parts, for example, operate efficiently in steam, chemical and gas valves to provide a corrosion resistant material operating under the most adverse conditions.

MECHANICALLY STRONG—GRAPHITAR will not warp or distort even in high pressure applications. Compressive strength up to 45,000 psi and transverse breaking strength from 3000 to 16,000 psi, depending on the grade.

HEAT RESISTANT—GRAPHITAR is not affected by heat under neutral or reducing conditions. Temperatures of oxidation for most grades is approximately 700 degrees F. In addition, GRAPHITAR engineers have developed a special oxidation resistant grade of GRAPHITAR that has been exposed in an oxidizing atmosphere (air) of 1200 degrees F. and after 200 hours, it showed a weight loss of less than six per cent.

MOLDABLE—GRAPHITAR has excellent moldability properties that make possible and practical unusual shaped parts. Design requirements such as ears, face slots, and outside diameter notches can easily be incorporated into GRAPHITAR parts without secondary machining and finishing operations.

MACHINING—The United States Graphite Company operates an excellent finishing department to do all finishing operations to the most exacting specifications. GRAPHITAR may be ground to size or shaped with a tungsten carbide or diamond tipped tool to tolerances as close as .0005". When surfaces require a high degree of precision in flatness, lapping and polishing equipment are employed and accuracies within three light bands can be produced.

LIGHT WEIGHT—GRAPHITAR is lighter than magnesium and is being employed increasingly in the aircraft and missile fields. The weight per unit volume of various GRAPHITAR grades is as follows: 102.8 to 116.03 pounds per cubic foot, .0595 to .0672 pounds per cubic inch, .952 to 1.074 ounces per cubic inch.

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R-284-1

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DIVISION OF THE WICKES CORPORATION, SAGINAW 2, MICHIGAN

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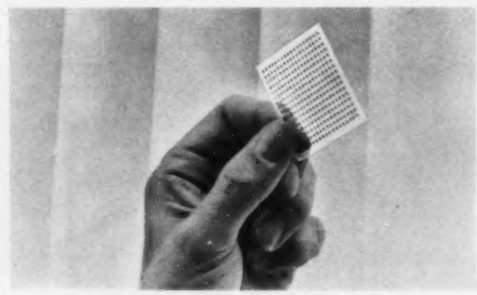
RELEASES

• **THIN-FILM COMPUTER MEMORY** makes possible a whole new generation of computers that operate in nanoseconds, billionths instead of millionths of a second. The memory consists of a series of metal dots, a few millionths of an inch thick, made by depositing vapors of iron, nickel, cobalt or other ferro-magnetic metals on a suitable sub-strate, such as a thin glass plate.

The film has very unusual properties when deposition is made under controlled conditions. For example, if a magnetic field is applied parallel to the surface of the sub-strate during deposition, the thin film then becomes easier to magnetize in the direction of the field in which it was applied than it is at right angles to that direction. This property permits the magnetic state of such a film to be switched in as little as one billionth of a second. In a computer memory, this means that information can be stored in and retrieved from the memory with a speed directly



related to the speed required for switching the magnetic state of the memory.

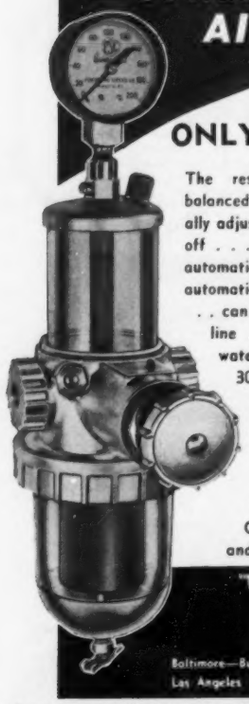
In addition to the high-speed switching-time of magnetic states possible, the memory's store of information can be interrogated and read out millions of times without destruction. It also requires less electric power for energization than do other memories.

A delicate operation is employed to connect deposits of film to the computer circuitry. Since ordinary wires cannot be used, multi-layer printed wiring on plastic material is required. Ferro-magnetic film arrays are laid onto the printed circuit. The arrays, made up of individual circular ferro-magnetic film elements about ½ mm in dia, are placed on the multi-layer circuit etched in a grid pattern. When the copper matrix is covered with the arrays, it is closed to connect the circuit.

The thin-film computer memory was announced by the Remington Rand Univac Div. of Sperry Rand Corp.

STREAMLINED AIR CONTROL

ONLY 2 Settings Connections



The rest is automatic. Self-cleaning balanced piston REGULATOR automatically adjusts when tools are added or taken off . . . acts as a shut-off valve . . . automatically bleeds off. LUBRICATOR automatically proportions oil to air volume . . can be filled without turning off air line . . . FILTER removes free oil, water, and solid particles down to 30 microns . . . drain valve blow off . . . Filter and Lubricator have visual controls.

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• **ROCKET INSTABILITIES** are studied by engineers of the University of California's Engineering Field Station in Richmond. The studies are an attempt to discover fundamental physical laws governing combustion instabilities.

No one really knows, although theories are available, why rockets explode on the pad or shortly after take-off. Within certain narrow limitations, rocket manufacturers have achieved successful designs on the basis of trial and error. The ideal would be to know enough about rocket instabilities to be able to design a rocket right the first time and to be able to say, "This design will work."

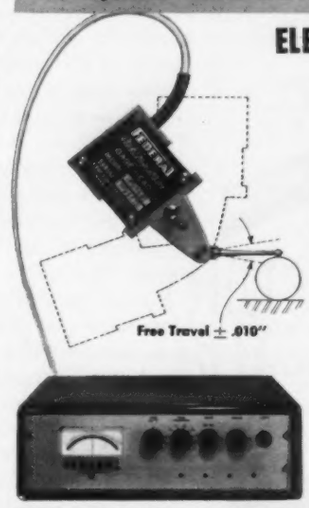
Two basic types of instability causing the trouble are known as "screech" and "chugging". Either can result in a blow-up or a burnout. Screech occurs when the chemical reaction between the two fuel components happens to be "in tune" with the volume of the combustion chamber. With chugging, the fuel is supplied and burned at an uneven rate because of pressure waves built up within the chamber. Both are related to the geometry of the chamber.

The research group is test firing a small rocket engine under a variety of physical conditions and comparing results to available theories. Ultimately the group hopes to derive more exact relationships between instability and combustion chamber geometry, which can then be used in the design of more stable rocket engines.

GAGE PAGE

A Quick Run-down of New Gaging Ideas

ELECTRONIC GAGING—*Economically*

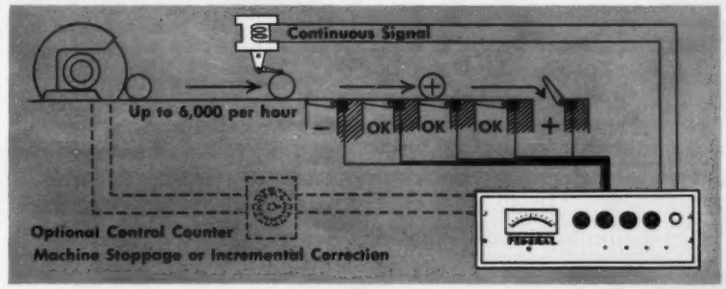


Small Electro-Probe Gage Head for bench or automatic applications.

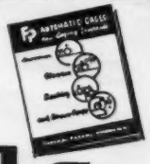
Highly versatile . . . Overtravel protected . . . Virtually frictionless response . . . Feather-light contact-pressure (less than 2½ grams) simplifies support design . . . Mounts in any position . . . Only 1½" x 2½" x 2½₂" thick . . . Impervious to oil and water . . . Works with variety of Amplifiers and combined Amplifier-Classifiers.

— for example 230M-27 (pictured) provides 8 gaging ranges . . . min. grads. from .000010" to .002" . . . Center zero meter . . . Four control limits which can be preset from panel . . . Classifies into five size categories, e.g. "over", "under", and three classifications of "good". — This precision combination for about $850.

Gage Head with dual-range Amplifier is less than $500.



For complete specs, dimensions — the *whole* story — send for Catalog 60 AM.



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FOR RECOMMENDATIONS IN MODERN GAGES . . .

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INVENTOR MANUFACTURER

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Try **IDEA MART** . . . for Effective Communications.

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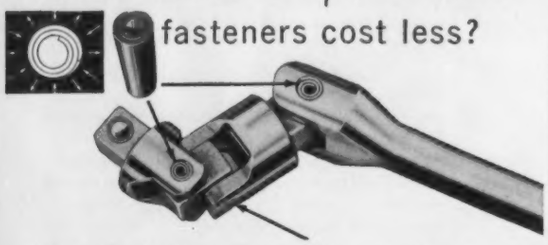
Why do

SPIROL *the true spring* **PIN**



fasteners cost less?

1. 80% of spring pin applications only require Medium Duty SPIROL PINS, which cost less.
2. Even the Heavy Duty SPIROL PINS in this socket-wrench universal joint don't cost more than other types of spring pins.
3. Assembly costs are lowered with SPIROL PINS! Just drill the hole (plus and minus tolerances allowed only by SPIROL PIN) and drive the pins—automatically or by hand.
4. Medium and Light Duty SPIROL PINS replace more costly fasteners, even in materials where other spring pins cannot be used. Come in Miniature Diameters, too: 1/32" to .052".

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Important SAVINGS to VOLUME users of small parts

...like these

SHOWN TWICE SIZE

thanks to MULTI-SWAGE

Many large volume users of solid pins for electronic and mechanical purposes have cut costs by switching to Multi-Swaged *tubular* pins . . . without sacrificing strength or accuracy. Multi-Swage parts serve as terminal contacts, bearing pins, stop pins, male-female connections, etc., in a wide variety of products such as Business Machines, Ventilator Louvres, Toys, Radio and Television Apparatus, Terminal boards, Electric Shavers, Phonograph Pickups, etc. Send part (up to ¼" dia. and to 1½" length) and your specs for a quotation. Or write for DATA BULLETIN.

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Manufacturers of BEAD CHAIN—the kinkless chain of a thousand uses, for pull and retaining chains and other industrial uses; plumbing, electrical, jewelry, fishing tackle and novelty products.

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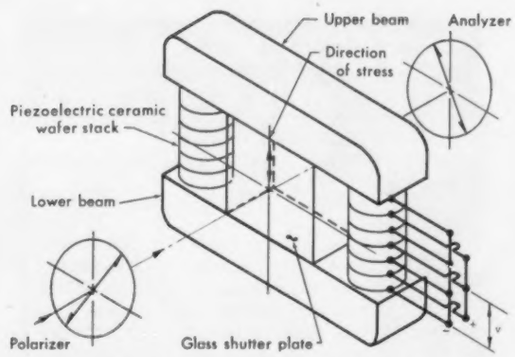
RELEASES...

• **FIELD TESTS,** to establish feasibility and check out prototype equipment for a space communications system that utilizes solar radiation, have been completed by Electro-Optical Systems, Inc. Communications were carried out over simulated distances as great as 10 million miles.

Signal-to-noise ratio at a range of one million (simulated) miles was approximately 16 db. Distortion of signal was quite low. Transmission rate of information during the tests was approximately 10 bits per sec at the maximum range. At shorter ranges, this rate can be increased substantially.

Several types of modulators for coding the light beam were used during the tests. Among these, the most suitable was a stressed plate shutter. This device has the advantage of light weight, low power requirements (approximately 3000v) and can accommodate large amounts of radiation without overheating.

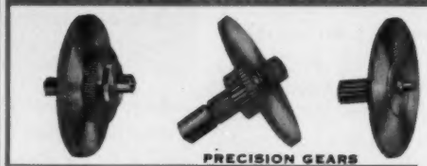
The stressed plate shutter utilizes an ordinary piece of glass plate mounted between a pair of rigid beams. Placed at either end of the beams are stacks of piezoelectric drivers. Voltage applied to these driver stacks causes them to expand or contract, depending upon the voltage polarity. This strain is transmitted by the rigid beam assembly to the shutter plate. Strain induced in the glass causes temporary double refraction which will change the state of polarization of a light beam passing through the shutter plate.



If the shutter plate is mounted between a pair of crossed or parallel polarizers and a modulation voltage is applied to the driver stacks, the light beam passing through the modulator will be modulated from a full open to a full close.

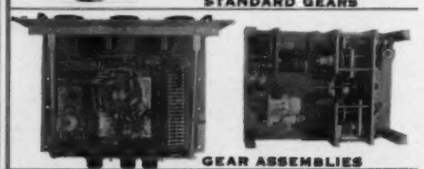
Both transmitter and receiver antennas utilize variable orientation Cassegrainian mirror systems that permit collection of solar radiation from any angle. An accurate sun tracking mechanism is a vital part of the transmitter's collecting array.

FOR YOUR PRECISION AND SPECIAL GEARING REQUIREMENTS . . . LOOK TO **Arch**



PRECISION GEARS

STANDARD GEARS



GEAR ASSEMBLIES

CUSTOM DIFFERENTIALS

ARCH

IN PRECISION GEARING Arch Gear offers you a thoroughly skilled group of gear specialists operating the latest in gear cutting and processing equipment to produce to your specifications all types and classes of precision gears at low unit costs . . . . .

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CUSTOM DIFFERENTIALS are a product of Arch Instrument, a separate manufacturing entity devoted to meeting the needs for space-age tolerances. With ten models from 1/16" to 5/16" in both hollow and solid shaft units, Arch offers you the most advanced line of differentials available. Assembly, testing, calibration and packaging is performed in a specially constructed white room to assure specified tolerances and performance.

IN GEAR ASSEMBLIES, another specialty of Arch Instrument, we offer you complete design and engineering assistance on gear trains and other servo gear assemblies. From a pilot model to a large number of production units, Arch is equipped to produce to exacting specifications as well as perform the assembly and testing of the complete electro-mechanical package . . . . . .

Why not investigate the gearing abilities of Arch? Write for complete information and literature today . . . . . .

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Low leakage
No dynamic
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3000 p.s.i. pressure—rated pressure may be applied to all ports.

Operate solenoids without flow or pressure.

Light and compact—weighs only 5 pounds complete.

All moving parts operating in oil.

Simple stacking or banking of any number of valves with standard kits. Allows you to add on later.

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NFPA

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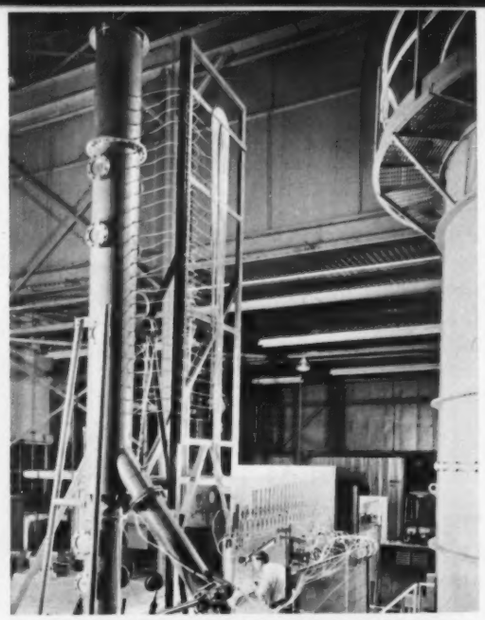

• **PROTOTYPE STEAM SEPARATOR,** designed specifically for internal use in boiling water reactors, has been completed recently by Allis-Chalmers. The internal steam separator will nearly eliminate carry-under which would reduce the capacity of the recirculation pumps. Carry-under would also reduce the power capacity of the reactor. Moisture de-entrainment equipment will be used to minimize carry-over of moisture into the superheater section.

A mixture of steam and water enters a long vertical tube through a tangential nozzle along the length of the separator. The centrifugal force of the resulting vortex causes the water to flow to the outside of the tube and steam to collect in the center. The steam rises and passes out the top of the separator to the superheater; the water flows out the bottom to be recirculated through the reactor core.

• **ELECTRONIC DEVICE** permits nuclear engineers to "look" through the thick steel walls of an atomic reactor to see how much steam it is producing. The "neutron telescope" is basically a fast neutron counter in a special tube which can measure small differences in the steam output of selected fuel channels in the reactor.

The device is mounted above the core of the reactor. It can be aimed accurately at a fuel channel from a distance of 20 ft or more and will count fast neutrons coming up out of that section of the reactor through six ft of water and several inches of steel.

The neutron telescope was developed by Samuel Untermyer II, consultant at the Vallecitos Atomic Lab., Pleasanton, Calif., a component of G. E.'s Atomic Power Equipment Dept.

THIN
...BUT
PRECISE

Cutaway showing built-in shields

A ten-inch thin section bearing with extreme precision was the tough design specification GPL set for the supporting bearing in their Radan aerial navigation device. To meet these requirements ITI custom engineered a 4-point contact bearing with spring separators and shields, holding bearing torque to less than 6 inch-ounces under 40 pounds thrust, and maximum raceway runout to 0.0002" TIR. Complete technical data on this extra-thin bearing is available in our Tech-Tonic # 8, or for information on how ITI can design and produce in quantity other special bearings having corrosion resistance, unusual configuration, or high temperature capabilities, write for Bulletin AFB-2.

iTi

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manufacturers of precision balls and bearings
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PLUS PROTECTION AGAINST OVERLOAD

Maxitorq

overload release clutches

Designers and builders have found MAXITORQ Overload Release Clutches the ideal way to provide dependable protection against overload conditions.

Unlike such devices as shear pins, the MAXITORQ Overload Release Clutch requires no disassembly or replacement after functioning. Once the cause of overload is removed or corrected, the machine may be re-started at once. Furthermore, MAXITORQ Overload Release Clutches may be adjusted for pre-determined overload protection.

In addition, users enjoy the proved advantages of the MAXITORQ Floating Disc Clutch . . . smooth, positive engagement and release . . . "floating" neutral with no drag or heating . . . easy manual adjustment.

We will be glad to give you the benefit of our long and successful experience in clutch and brake design; the overload release clutches are only one of many advanced MAXITORQ developments in both manual and electrically operated applications. Ask for literature, or outline your problem . . . write Dept. DN.

THE CARLYLE JOHNSON MACHINE CO.

MANCHESTER • CONNECTICUT

2CJ60

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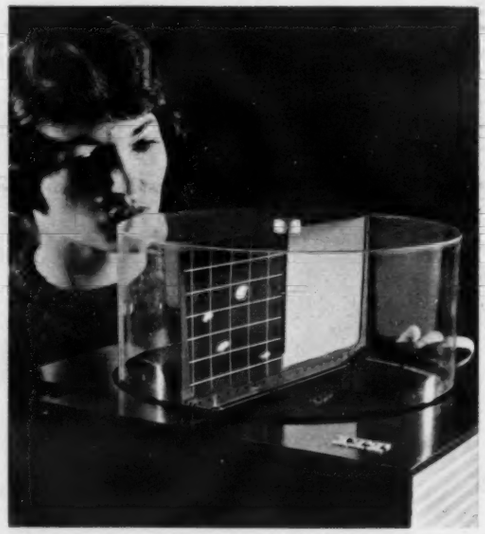
RELEASES...

• **THREE-DIMENSIONAL DISPLAY SYSTEM** has broad application in air traffic control, missile tracking, anti-submarine warfare and related fields. Pinpoints of light representing airplanes, missiles, satellites or submarines move through the display as directed by a computer or radar pulse to provide operators with a clear visual picture of the situation under study.

When employed for air traffic control, the confines of the display can be made to represent the airspace surrounding an airport control tower. Grid lines of light representing specified distances can be infused into the display to show the operator the precise position of each aircraft.

To attain the three-dimensional effect, the display rotates a translucent screen around a vertical axis at a constant speed that renders the screen invisible. Images of aircraft or other targets being tracked appear as steady points of light suspended in the display volume.



The observer is able to view the display from all sides and above. Were he in the ground control center of a major airport, he would be able to assess the air traffic situation at a glance and make the necessary decisions.

The display system was developed at International Telephone and Telegraph Corp.'s Laboratories in Nutley, N. J.

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For every application, specify Palmetto Packings—molded with precision to improve the quality of your products . . . designed to permit you economies which lower your costs.

PALMETTO PYRAMID—advanced form of V-packing. New Sealsaver Adapters—better, lower in cost than phenolic—now multiply V-ring life.

PALMETTO G-T RING—unique resilient ring seals without extrusion in pressures as high as 10,000 psi . . . will not wedge into clearances or twist in place.

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PALMETTO U-RING—for many applications where cup or V-packings formerly were required. "Snaps" into one-piece piston . . . eliminates glands, backing plates . . . saves space, machining.

PALMETTO KUP—sturdy, molded form of traditional piston packing. Kups resist heat and synthetic fluids . . . hold their shape . . . cannot become dried or hard.

Let Palmetto supply a recommendation for your current project. Send drawings and operating conditions for a specific product suggestion, and—today—ask for the Palmetto OEM product description sheet.

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NORTH WALES, PA.

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FASTENERS

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Sizes #0 and #1 Steel, Stainless Steel, Brass.

COLD HEADED PARTS, RIVETS, STUDS
Custom designed. Large production facilities.

HEADS Flat, Round, Oval, Fillister, Binding, Truss, Jackson, Washer, Pan, Knurled, Depressed Hex Head, Sems Fastener Units with Attached Shakeproof or split-type lock washers.

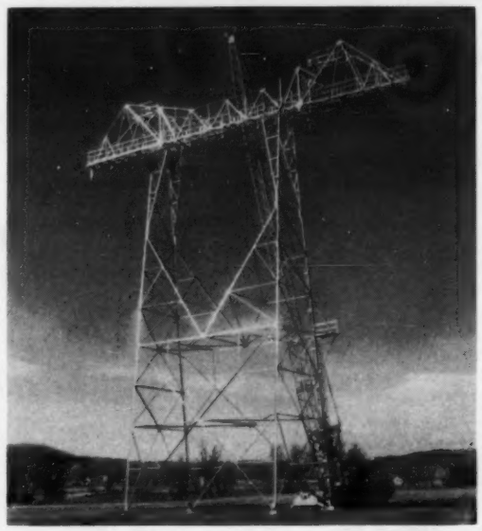
METALS Brass, Steel, Stainless Steel, Monel, Nickel Silver, Aluminum, Silicon Bronze, Commercial Bronze.

FINISHES Nickel, Cadmium, Zinc, Brass, Bronze, Chrome, Parkerizing, Iridite, Blued.

HARVEY
HUBBELL,
INCORPORATED
MACHINE SCREW DEPARTMENT
BRIDGEPORT 2, CONNECTICUT

Circle 81 on Reader-Service Card

• **FIRST ALUMINUM TRANSMISSION TOWER** for General Electric's Project EHV has been erected. Alcoa supplied the 105-ft high tower which weighs 11,400 lb. Ladders, catwalks, platforms and special testing equipment bring the installed weight to 14,880 lb. The bolted, lattice-type structure utilizes a "Y" structural shape for leg and crossarm members.



• **SODIUM VAPOR TRAIL** provides an almost foolproof method to track spacecraft descending from orbit, according to scientists at Lockheed Missiles and Space Div. research laboratories. The proposed non-electronic system would produce clearly visible light laying a glowing orange-red trail in near-space across hundreds of miles of sky. It would show almost exactly where the spacecraft would reach earth, indicate its velocity and show clearly any deviation from planned trajectory. The light-generating vapor trail could be observed easily by naked eye, telescope or camera.

Sodium vapor at these altitudes works exactly like a gigantic sodium vapor lamp. At 60 miles, the necessary vacuum is already there and high-energy particles at the fringes of space supply energy in the same manner as electricity supplies energy for highway lamps. The sodium energized by this space radiation emits large quantities of light.

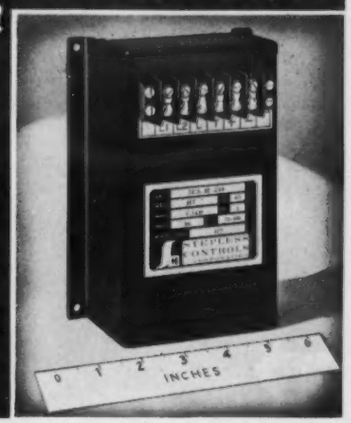
At altitudes of between 124 and 44 miles the glowing trail would be stable for around 30 minutes and precise measurements would show exactly the angle of descent and conformity to flight path. Release of the sodium at timed intervals would give precise velocities. Lockheed estimates that 10 lb of sodium would lay a 100-mile track.

"STEPLESS" TAKES THE FIRST STEP!

A MAJOR IMPROVEMENT IN TEMPERATURE CONTROL FOR FURNACES

PROPORTIONAL CONTROL OVER FULL RANGE OF FURNACE LOAD WITH SOLID STATE SWITCHING USING SILICON CONTROLLED RECTIFIERS.

- REPLACES SATURABLE CORE REACTOR AND MAGNETIC AMPLIFIER SYSTEM
- NO MORE DESIGN LIMITATION DUE TO NEED FOR MATCHING LOADS
- ELIMINATES COSTLY CONTACTOR FAILURE PROBLEMS



Stepless Control's Power-Prop® is basically a power input control that will operate from any pyrometer with a proportioning D.C. voltage output signal.

Available from stock for up to 75 Amps and up to 230 Volts A.C.

BTU Engineering Corporation, Waltham, Mass., has utilized these units successfully for the past 2 years in furnaces for the semiconductor industry.

STEPLESS CONTROLS CORPORATION
WALTHAM 54, MASS

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SYNCHRO NEWS!

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60 & 400 CYCLE

ALL SIZES—11 through 23
ALL TYPES — Transformers, Transmitters, Differential Transmitters — Thru-Bore and Standard
ALL ENGINEERED & MANUFACTURED TO:
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MIL-S-12472 MIL-S-20708A
ALL AVAILABLE WITH MAXIMUM ELECTRICAL ERROR OF ±3 MINUTES! A major break-through, made possible by VERNITRON specialization in precision synchro component design and manufacture.

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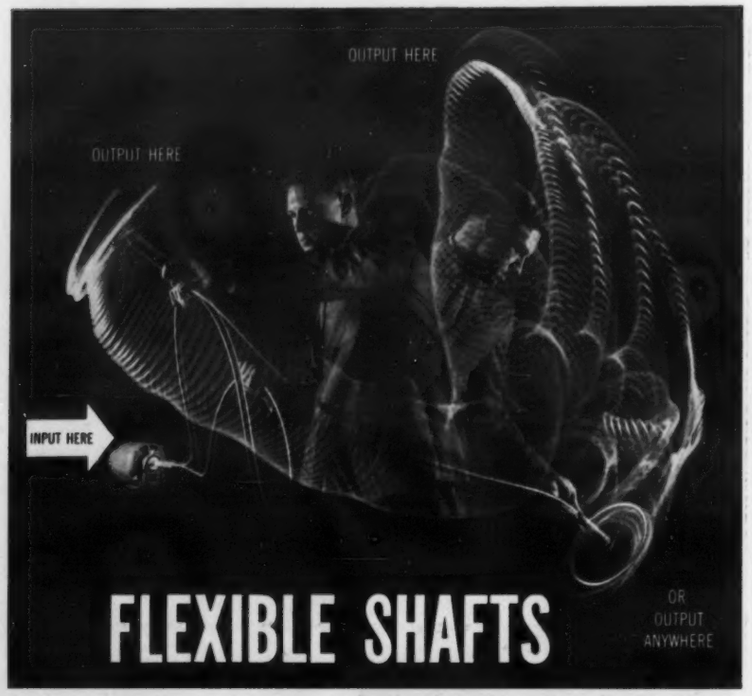

put power where you want it

Flexible shafts give the designer important new freedom in transmitting rotary power or control between two points. They enable you to position your power source and your driven part to best advantage . . . without worrying about obstructions, vibration, shock or alignment.

Even if the components are in relative motion to each other, you can still transmit power smoothly and economically.

Flexible shafts also reduce manufacturing costs . . . use fewer parts . . . eliminate cumbersome gears, drives, couplings, universals. With rigid connections gone, alignment and tolerance problems fade away, and installation is a snap.

Whatever your rotary transmission problem, there is a good chance that one of S. S. White's flexible shaft lines can solve it . . . *Standard, Pre-Engineered,* or *Custom-Designed* flexible shafts.

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FIRST NAME
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PLANS AND CROSS-SECTIONS

Billy Club with a Buzz

A new all-purpose billy club should help policemen lay down the iron hand of the law. Devised by S. T. Voll of Great Falls, Mont., it will enable policemen to keep law breakers subdued without using force or injurious weapons. The club has a hook that can be attached to the prisoner. The hook delivers an electric shock. The source of the electric charge is inside the club so no outside current source is needed. Another feature of the invention is that it can also be used for signaling or as a flashlight.

The boss wants to see an end view.

FACTS . . . you may have missed

. . . A test at Britain's National Physical Laboratory showed that the most annoying noise known to man is that made by scraping a saucepan with a knife.

. . . The aroma of cooked oysters is caused mainly by dimethyl sulfide.

. . . A firefly breeding farm is the next project of a Japanese high school science club which already has successfully raised 100,000 fireflies.

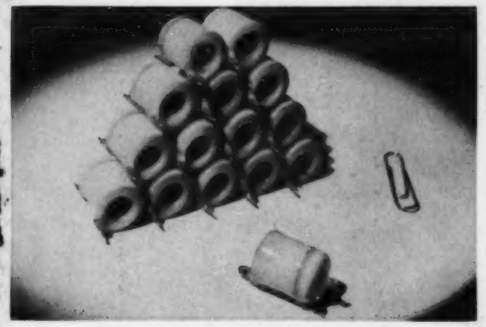
. . . A portable X-ray type machine, recently patented, promises easier and more accurate diagnosis of sick trees and rotting telephone poles.

Completing the Cycle

The old principle of the hourglass is the key to a fluid-timed parking meter, recently patented by S. K. Wood and W. J. Friesen of Hutchinson, Kan. A coin dropped into the meter starts a non-freezing liquid flowing from one compartment to another in an enclosed vial. As the liquid drips through, a T-arm attached to the center portion of the vial swings over, moving the time scale printed on the cross bar of the "T" toward violation position.

IN BRIEF

• **MINIATURE TRIGGERED SPARK GAP** capable of switching 18 joules of energy at 3000v, by remote control, has been developed by the General Electric Power Tube Dept. Primary use is for switching a single stored electrical energy system into low-impedance loads, as in the case of multiple explosive bolt operation. In such applications, the tube's extremely fast action of 1.0 to 1.5 microseconds and its rugged reliability are of primary importance. The Z-5362 is a gaseous, cold-cathode switch tube requiring no warm-up time.



• **NAME THE NEW MOTOR** contest for design engineers has been announced by Franklin Electric Co., Inc. Only design engineers are allowed to participate. Purpose of the contest? To find a name for the new Franklin aluminum motor. The engineer who submits the best name will receive a 16-ft Starcraft aluminum lapstrake runabout, plus a 40-hp Evinrude outboard motor. Only requirement of the contest is to submit a name that reflects one or more features of the new motor. A sheet, detailing the characteristics of the aluminum motor, and a contest entry blank are available by writing Franklin Electric Co., Inc., Bluffton, Ind. Contest closes Feb. 28, 1961.

• **FUEL CELLS** are now a practical source of power, according to General Electric. A packboard-mounted unit being readied for the Marine Corps will supply all the power needed for portable field radar. It will take the place of a 55-lb engine generator set or 60 lb of the most modern batteries. In addition to being noiseless, the new power pack is highly efficient. It will operate a mobile radar set at full power for a week, using only 136 lb of fuel. In contrast, nearly a half ton of freshly charged batteries would be required to do the same job on a battery-operated set.

ELECTRONIC

WAR TERMINATION INVENTORIES

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Pasadena 8, California
MUrray 1-7393

SIMPLE DIFFERENTIAL WITH BALL-BEARING SUN GEARS

The 1:1 reverse ratio spur gears are 48-tooth, 32 pitch brass with 3/16" available face. On one side, the shaft is .23.64" dia. for 11/16" and has a pin hole, then increases in dia. to .377" for the remaining 3/16" of length. On the other side, the shaft is .377 dia. ¼" lg. 2-13/16" dia. is required to clear the body.
Stock no. A6-115 .....each $15.00

SIMPLE DIFFERENTIAL WITH SPACED OUT SUN GEARS

1:1 reverse ratio spur gears are aluminum, 3/32" face, 32 pitch, 32 tooth on one side, 48 tooth on the other. The body is ⅝ thick, but the sun gears are spaced out so that they are 1½" apart. ½" dia. shaft on each side is 23/32" long. OA length 3¼". Requires 1-23/32" dia. to clear the body.
Stock no. A6-124..... each $4.50

SIMPLE DIFFERENTIAL

1:1 reverse ration, 60 teeth on large gear; ¼" shaft. Size: 3" long with 1-15/16" dia.
Stock no. A6-104 .....each $3.95

DUAL SIMPLE DIFFERENTIAL

1:1 reverse ratio on both.
Size: 3¼" long x 1-7/16" dia. Shaft size: ⅛" and 5/32".
Stock no. A6-107 .....each $7.50

SPERRY VERTICAL GYRO

Part #673073, Motor 115 volts, 3 phase, 400 cycle, 8 watts, 20,000 RPM. 3-minute runup, synchro pickoffs, roll 360°, pitch 85°. Synchro excitation 26 volts, 400 cycle, 150 m.a. Vertical accuracy ±½°. Weight 3½ lbs. Approx. dim. 5¾" L., 4½" W., 4½" H.
Price $35.00

MINNEAPOLIS-HONEYWELL RATE GYRO (Control Flight)

Part no. JG7005A, 115 volts A.C., 400 cycle, single phase potentiometer take off resistance 530 ohms. Speed 21,000 r.p.m. Angular momentum 2½ million, CM²/sec. Weight 2 lbs. Dimensions 4-7/32 x 3-29/32 x 3-31/64.
Price $22.50

VARIABLE SPEED BALL DISC INTEGRATORS (All Shafts Ball Bearing Supported)

No. 145 Forward & Reverse 2¼"-0-2¼. Input shaft spline gear 12 teeth 9/32" dia. ⅝" long. Output shaft 15/64" dia. x 15/32" long. Control shaft 11/32" x ⅜" long. Cast aluminum construction. Approx. size 3" x 3" x 2¼" $17.50

No. 146 Forward & Reverse 4-0-4. Input shaft 5/16" dia. x ¾" long: Output shaft 15/64" dia. x 9/16" long. Control shaft 11/64" dia. x 11/16" long. Cast aluminum construction. Approx. size 4½" x 4½" x 4".

$18.50 ea.

SMALL DC MOTORS

(approx. size over 3¼" x 1¼" dia.:

5067043 Delco 12 VDC PM 1" x 1" x 2", 10,000 rpm. $7.50
5067126 Delco PM, 27 VDC, 125 RPM, Governor Controlled 15.00 ea.
5069600 Delco PM 27.5 VDC 250 rpm 12.50
#5069625 120 rpm, mfr. Delco, 27 VDC governor controlled $15.00
5069230 Delco PM 27.5 VDC 145 rpm 15.00
5068750 Delco 27.5 VDC 160 rpm w. brake 6.50
5068571 Delco PM 27.5 VDC 10,000 rpm (1x1x2") 5.00
5069790 Delco PM, 27 VDC, 100 RPM, Governor Controlled 15.00 ea.
#5069800 575 rpm, mfr. Delco, 27 VDC, PM reversible governor controlled, equipped with 27 VDC c¹.tch $17.50
5072735 Delco 27 VDC 200 rpm governor controlled. 15.00
5BA10A11B GE 24 VDC 110 rpm 10.00
5BA10AJ37 GE 27 VDC 250 rpm reversible 10.00
5BA10AJ52 27 VDC 145 rpm reversible 12.50
5BA10AJ50, G.E., 12 VDC, 140 rpm 15.00
5BA10FJ401B, G.E. 28 VDC, 215 rpm, 10 oz. in., 7 amp. contains brake 15.00
5BA10FJ421, G.E. 26 VDC, 4 rpm, reversible, 6 oz. in., .65 amp 15.00

400 CYCLE PM GENERATOR

Mfgd. by T K M Electric Corp.
Model #A-12
120/208 volts, 400 cycle, 1 or 3 phase, 1 kva, pf 0.8, rpm 8,000. Approx. dim. 6" x 5½". Internal spline drive. Price $100.00

400 CYCLE ⅓ PHASE GENERATOR

115 VAC. 3 KVA. Mfg. Bogue Elect. Mod. 2800S. External excitation 107 VDC. 1.1 amp. 3450 rpm. 1" shaft. $200.00

400 CYCLE MOTOR GENERATOR

2kw, 208/115 volt AC, 3 phase, 400 cycle
Input: 220 volts AC, 60 cycle, 3 phase 3 h.p. motor
Unit manufactured by Bogue
Consists of squirrel cage induction motor driving through a flexible tubing, a salient pole, synchronous generator, with direct connected exciter.
Unit complete with starting contractor, voltage adjusting rheostat, carbon pile voltage regulator and 28 volt DC, 5 amp rectifier power supply.
Price $450.00

SELSYNS-SYNCHROS

1CT cont. Trans 90/55V 60 cy.....$27.50
1DG Diff. Gen. 90/90V 60 cy..... 34.50
1F Syn. Mtr. 115/90V 60 cy..... 34.50
1G Gen. 115V 60 cy..... 34.50
1HDG 37.50
1HCT 37.50
1SF Syn. Mtr. 115/90V 400 cy..... 12.50
23TR4 torque receiver..... 34.50
23TR6 torque receiver..... 37.50
23CT6 control transformer..... 37.50
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7DG differential generator..... 37.50
2J1F1 Gen. 115/57.5V 400 cy..... 7.50
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2J1FA1 Gen. 115/57.5V 400 cy..... 7.50
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6DG Diff. Gen. 90/90V 60 cy..... 25.00
6G Syn. Gen. 115/90VAC 60 cy..... 34.50
7G Syn. Gen. 115/90VAC 60 cy..... 42.50
C56701 Type 11-4 Rep. 115V 60 cy..... 20.00
C69405-2 Type 1-1 Transm. 115V 60 cy.... 20.00
C69406 Syn. Transm. 115V 60 cy..... 20.00
C69406-1 Type 11-2 Rep. 115V 60 cy..... 20.00
C78248 Syn. Transm. 115V 60 cy..... 12.50
C78410 Repeater 115V 60 cy..... 20.00
FPE 49-7 Diehl servo motor, 115 volts, 60 cycle, 10 watts..... 30.00

400 CYCLE, 3 PHASE GENERATOR BY MASTER ELECTRIC

Type AG, frame 364Y, 7.5 kw, 3428 rpm, pf .95 Star connected 120/208 3 phase, 22 amps. Delta connected 120 volt single phase 6 amps. Self excited. Complete with control box, voltage regulator, AC voltmeter and frequency meter. Shaft 1" dia., 2" long; overall dim. of unit: 21"6x18"x 20"
Price $395.00 each

SILICON RECTIFIERS

All rectifiers listed at maximum peak inverse voltage ratings; approximate forward voltage drop, 1.5 volts

1N1446	.750 amp.	100 volts	.65
1N1447	.750 amp.	200 volts	.75
1N1448	.750 amp.	300 volts	.85
1N1449	.750 amp.	400 volts	1.00
1N1551	1 amp.	100 volts	.80
1N1552	1 amp.	200 volts	.95
1N1553	1 amp.	300 volts	1.10
1N1450	5 amp.	100 volts	1.00
1N1451	5 amp.	200 volts	1.25
1N1452	5 amp.	300 volts	1.50
1N1453	5 amp.	400 volts	2.00
1N1454	25 amp.	100 volts	3.00
1N1455	25 amp.	200 volts	3.50
1N1456	25 amp.	300 volts	4.50
1N1458	35 amp.	100 volts	3.50
1N1459	35 amp.	200 volts	4.00
1N1460	35 amp.	300 volts	4.50
1N1461	35 amp.	400 volts	5.00
1N05P7	50 amp.	50 volts	6.00
1N1462	50 amp.	100 volts	7.00
1N05R7	75 amp.	50 volts	9.00
1N1466	75 amp.	100 volts	10.00
1N1467	75 amp.	200 volts	11.00
1N1468	75 amp.	300 volts	12.50
10T7	100 amp.	100 volts	13.00
00T7	100 amp.	150 volts	13.50
1N05V7	150 amp.	50 volts	16.50
1N1474	150 amp.	100 volts	17.00

Mounting for full wave bridge circuit to accommodate .750 amp. rectifiers...75¢ each

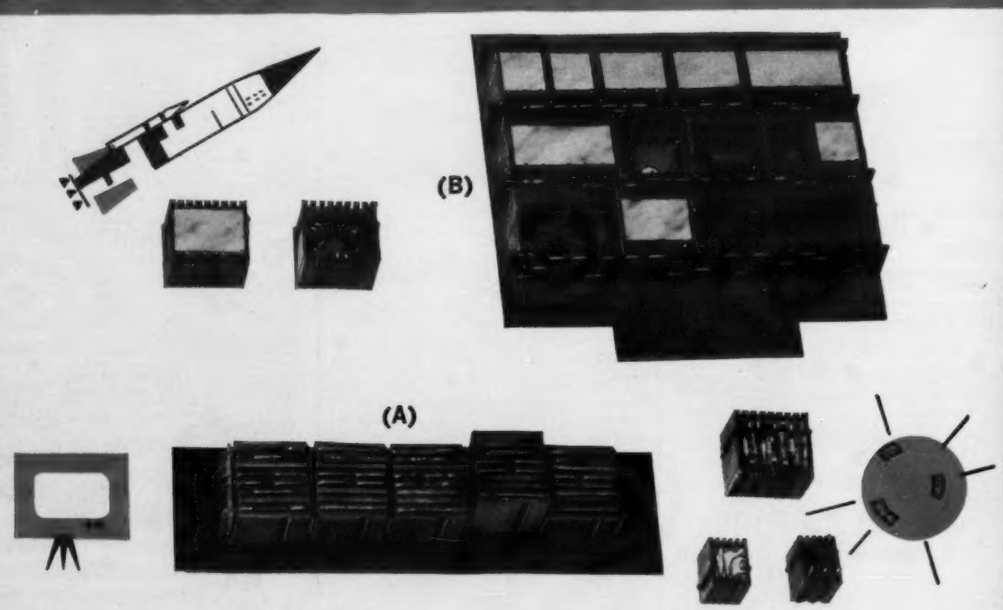
Circle 85 on Reader-Service Card for more information

FOR 3-D CIRCUITRY IN OR OUT OF THIS WORLD

From consumer to cosmos . . . at home with wall-to-wall carpeting or out among the stars . . . wherever modern electronic functions are used . . . AMP-MECA's new 3-D circuitry concept gives you two basic and very important advantages:

1. EASY DESIGN: Circuit designs, based on cellular units plugged into circuit-carrying side rails, can be laid out on graph layout sheets in hours rather than days or weeks.

2. TESTING AND MAINTENANCE: Potted cell modules or repairable cell modules are pluggable for ease in testing or maintenance.



Shown above (A) series, and (B) parallel circuits.

AMP-MECA gives the designer "building-block" latitudes . . . can be large or small as required . . . accommodates present standard or the most advanced molecular components and is equally at home in commercial as well as the most complex military equipments. Whether you're dealing with standard components, micro-miniature components, micro-modules, or thin films for use in proprietary or commercially available circuits, AMP has the solution to your interconnection problem.

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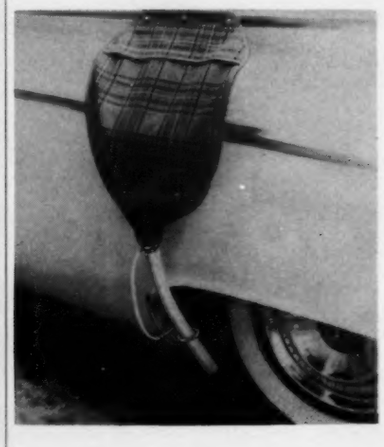
IN BRIEF...

• **PUSH BUTTONS AND PLASTICS** combine to contribute to safe winter driving through a new concept in passenger car accessories. Designed and manufactured by Highway Safety Appliances, Div. of Napco Industries, Inc., Minneapolis, Minn., the "Skidmaster" is a detachable grit spreader which is controlled by a vacuum release valve. A push-button control on the dashboard releases a flow of grit or sand under both rear wheels through flexible plastic tubing.



Meetings

Chicago, Ill. **Feb. 2-3**	INDUSTRIAL MANAGEMENT ENGINEERING CONFERENCE, Illinois Institute of Technology.
Chicago, Ill. **Feb. 7-9**	REINFORCED PLASTICS DIVISION CONFERENCE, Society of The Plastics Industry, Edgewater Beach Hotel.
St. Louis, Mo. **Feb. 19-23**	ANNUAL MEETING, American Institute of Mining, Metallurgical and Petroleum Engineers.
New Orleans, La. **Feb. 26-March 1**	NATIONAL MEETING, American Institute of Chemical Engineers, Roosevelt Hotel.

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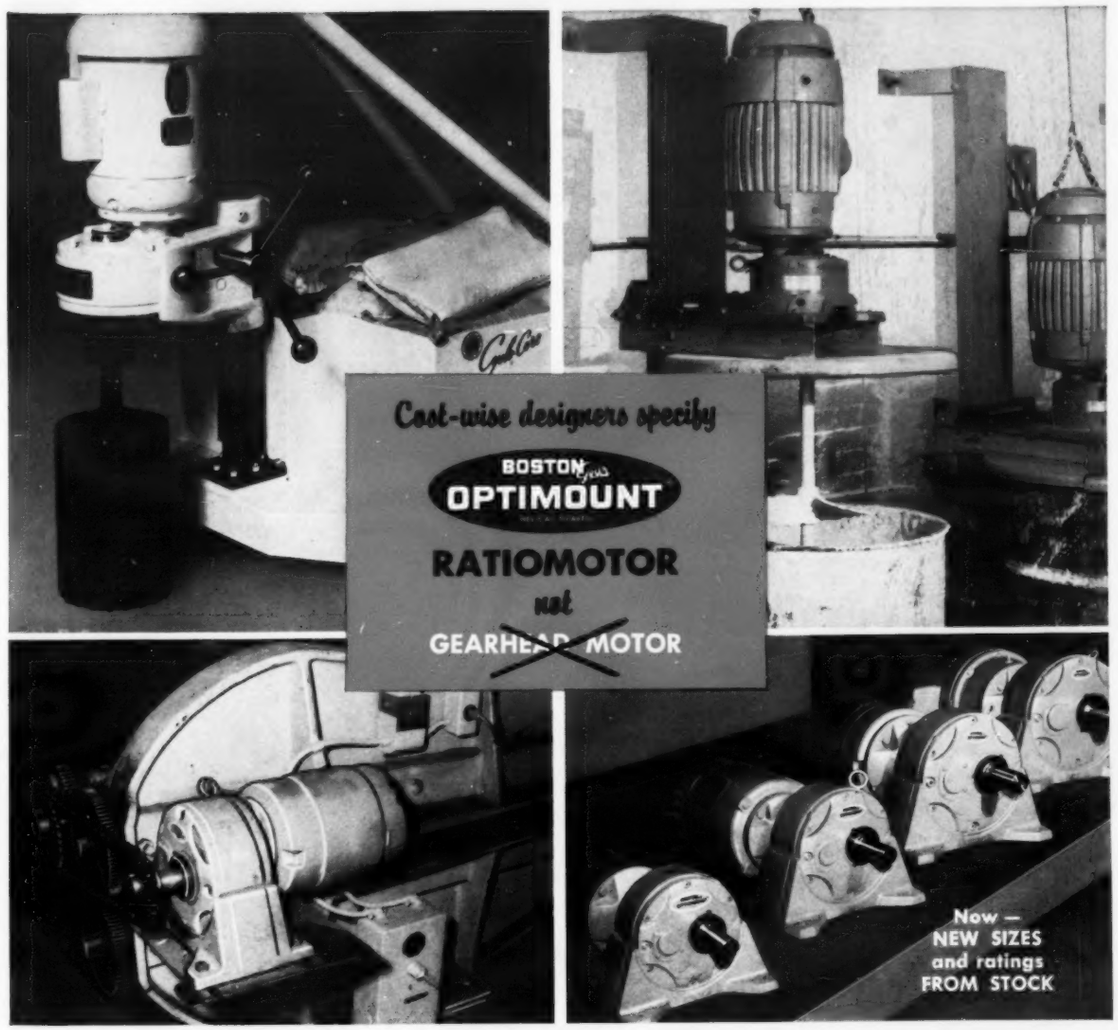
Published bi-weekly by Rogers Publishing Co. E. S. Safford, Chairman of the Board; President, T. A. Rogers; R. H. O'Brien, H. R. Roome, G. F. Taylor, G. Van Ark, Vice Presidents. Editorial, Advertising and Subscription Offices: 3375 S. Bannock, Englewood, Colo. Telephone: SUnset 9-0571. Published at 85 W. Harrison St., Chicago 5, Ill. Accepted as Controlled Circulation Publication at Chicago, Illinois. Send form 3579 to subscription offices.

Circulated without charge upon request on Company letterhead paper to design engineers in plants manufacturing engineered equipment in the continental U. S. who are responsible for the specification of parts, materials, finishes and engineering department equipment. Subscriptions to others in the continental United States, $20 per year.



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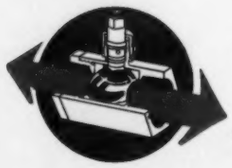

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1. Standard flange with PC 50 operator.
2. Screwed end type
3. 6" flange with ST 490 operator
4. 6" flange for manual operation
5. PVC screwed end type
6. Screwed end with EM 25
7. Screwed end with PC 50 operator
8. 2" flanged valve
9. PVC flanged valve

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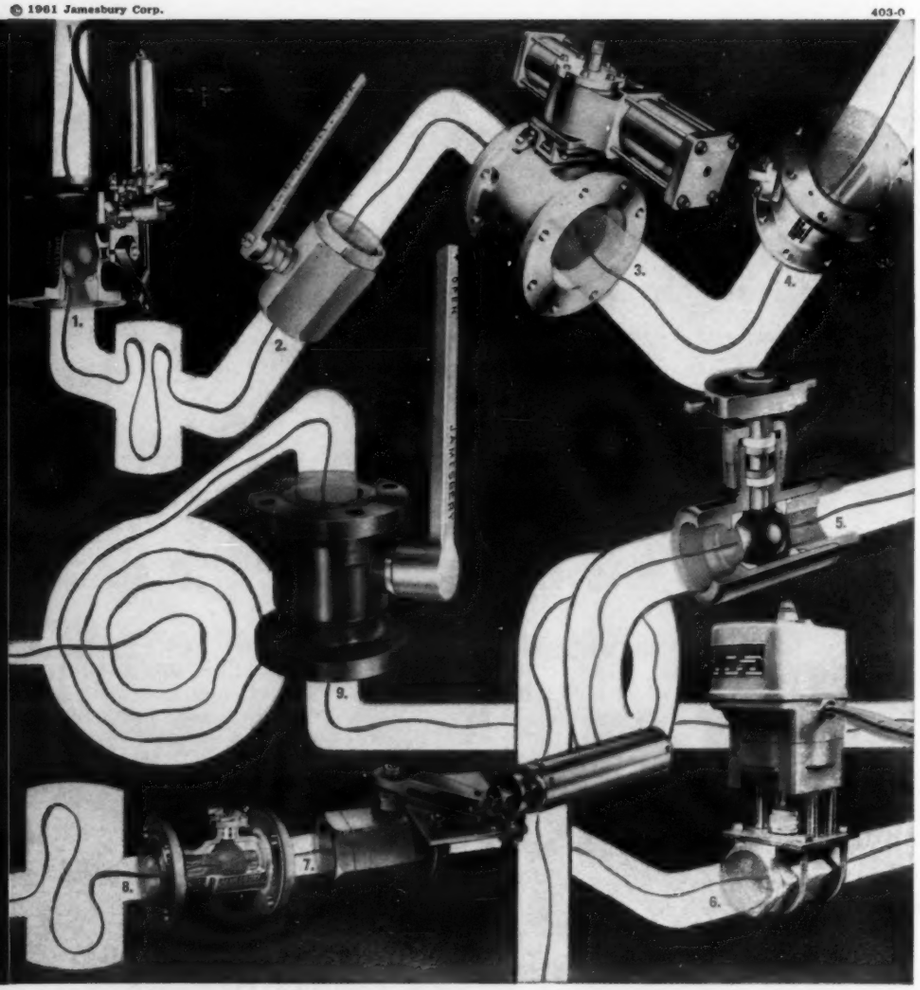
*10" and 12" on application.

*600# series on application.



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